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# The Hazardous Waste Minimization National Plan

# THE HAZARDOUS WASTE MINIMIZATION NATIONAL PLAN

## Executive Summary

The U.S. Environmental Protection Agency (EPA) is committed to making pollution prevention the guiding principle of the Agency's environmental efforts. The 1984 Amendments to the Resource Conservation and Recovery Act and the 1990 Pollution Prevention Act set in policy the preference for source reduction over waste management. EPA is reaffirming this commitment. With the release of the *Hazardous Waste Minimization National Plan* on November 18, 1994, EPA outlines its major goals, objectives, and action items to pave the way toward national reductions in the generation of hazardous waste.

This Plan focuses on reducing the generation and subsequent release to the environment of the most persistent, bioaccumulative, and toxic constituents in hazardous wastes, and establishes three goals:

1) To reduce, as a nation, the presence of the most persistent, bioaccumulative, and toxic constituents by 25 percent by the year 2000 and by 50 percent by the year 2005.

2) To avoid transferring these constituents across environmental media.

3) To ensure that these constituents are reduced at their source whenever possible, or, when not possible, that they are recycled in an environmentally sound manner.

EPA does not expect that each and every generator of persistent, bioaccumulative, and toxic constituents in hazardous waste will reduce the generation of these constituents in waste by the levels and time frames presented above. EPA intends for these reductions to be achieved nationally by EPA, states, and generators working together.

EPA encourages all states and generators of hazardous waste containing persistent, bioaccumulative, and toxic constituents to define their own baseline years, set their own goals and target years for achieving their goals, and track their own progress toward their goals. This flexibility will allow states and generators that have already begun source reduction and pollution prevention to begin measuring their successes from the year they started, and will give them flexibility in how they contribute to the national goals.

EPA sought widespread input from interest groups, citizens, industry, the states and federal regulators, and technical experts, to establish this Plan. Five key message recurred as a common theme throughout the many discussions and comments from the public, and the Agency used these to develop the backbone and five objectives of the Plan. The Plan presents a combination of voluntary, regulatory, and institutional mechanisms to achieve these objectives, as described briefly below:

- <u>Objective 1:</u> **Develop a framework for setting national priorities; develop a flexible screening tool for identifying priorities at individual facilities; identify constituents of concern.** EPA will prioritize pollution prevention efforts based on risk. The Agency will develop a screening tool to help states and industry set source reduction priorities. It will be based primarily on the inherent hazard of constituents but also will be applicable to hazards posed by management practices. The Agency already has developed a prototype screening approach addressing metals in hazardous wastes managed by combustion and metals in releases from combustion, and will use it to set initial waste minimization priorities.

  In addition, the Agency will use the screening tool to develop a list of high-priority constituents for source reduction and recycling, to assist those states and generators that are not able to apply the screening tool.

- <u>Objective 2:</u> **Promote multimedia environmental benefits and prevent cross-media transfers.** The Agency will propose guidance that encourages implementation of multimedia pollution prevention programs at all facilities. Pollution prevention often is not applied cohesively across different departments at facilities or between EPA or state offices and companies. EPA will work with states and facilities to incorporate efforts across media and avoid duplicative and counterproductive work.

- <u>Objective 3:</u> **Demonstrate a strong preference for source reduction; shift attention to the nation's hazardous waste generators to reduce hazardous waste generation at its source.** EPA will promote the focusing of technical assistance on small- and medium-sized generators of high-priority constituents; promote the incorporation of waste minimization in inspection, permit writing, and enforcement programs; develop demonstration projects focusing on priority constituents; and provide EPA Regions and states with waste minimization training for inspectors, permit writers, and enforcement officials, among other actions to achieve this objective.

- <u>Objective 4:</u> **Clearly define and track progress; Promote accountability for EPA, states, and industry.** EPA will identify data necessary to evaluate progress in reducing the most persistent, bioaccumulative, and toxic constituents. EPA will explore databases that contain information on hazardous waste quantities and how they are managed (such as the Biennial Reporting System (BRS) Database), and on how toxic chemicals are released to the environment and are managed (the Toxic Release Inventory (TRI) Database).

- <u>Objective 5:</u> **Involve citizens in waste minimization implementation decisions.** EPA will continue to encourage generators of hazardous wastes to share information with the public and be accountable to the public. In particular, EPA encourages facilities to share information on progress towards waste minimization initiatives that were specifically identified. EPA will publish guidance to EPA Regions, states, and industry, identifying how waste minimization information could be made available to the public.

# THE HAZARDOUS WASTE MINIMIZATION NATIONAL PLAN

## Historical Background

Over the past 20 years, the United States Environmental Protection Agency (EPA) has made great strides in environmental protection through the treatment and clean up of pollutants. It has become clear, however, that managing waste only after it is generated ("end-of-pipe" controls) cannot adequately address the important environmental issues facing the nation today.

In 1991, approximately 306 million tons of hazardous waste were generated in the United States[1]. In addition, approximately 3.2 billion pounds of toxic chemicals were released into the environment.[2] To reduce hazardous waste generation and toxic chemical releases to air, water, and land, EPA is committed to encouraging pollution prevention at the source whenever possible.

The Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA), emphasizes a national policy that focuses on source reduction as the highest priority. With the passage of HSWA, Congress specifically declared that the reduction or elimination of hazardous waste generation at the source should take priority over management (i.e., recycling, treatment, or disposal) of waste after it is generated.

In 1990, Congress further confirmed the key role of pollution prevention in the nation's environmental protection scheme, by passing the Pollution Prevention Act. In the Act, Congress essentially codified as law the hierarchy of management options that mirror those espoused by EPA's waste management programs, i.e., prevention first, then environmentally sound recycling, treatment, and disposal.

In her 1993 Earth Day statement, EPA Administrator Carol M. Browner said "this Administration is committed to making pollution prevention the guiding principle of all our environmental efforts." This Waste Minimization National Plan is a reflection of that commitment. (For definitions of waste minimization, source reduction, recycling, and pollution prevention, see Appendix A.)

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[1] Based on 1991 Biennial Report Data, United States Environmental Protection Agency.

[2] Based on "1992 Toxics Release Inventory; Public Data Release," United States Environmental Protection Agency, EPA 745-R-94-001, April 1994.

Previous Releases: Draft Hazardous Waste Minimization and Combustion Strategy and Draft Waste Minimization National Plan

On May 18, 1993, Administrator Browner released EPA's Draft Strategy on Hazardous Waste Minimization and Combustion. One of the Strategy's main goals was to reduce the amount of hazardous waste generated in this country through establishing a strong preference for source reduction over waste management. It also called for a better method of encouraging public participation in setting a national source reduction agenda. Over the next 12 months, EPA held discussions with various stakeholders including public interest groups, citizens, industry, state and federal regulators and technical experts. These discussions focused on waste minimization and other goals identified in the Draft Strategy.[3]

Then, in May of 1994, EPA released the Draft Waste Minimization National Plan. The Draft Plan proposed a series of waste minimization initiatives to reduce the amount of hazardous waste destined for combustion, and proposed a longer-term effort to minimize all hazardous waste generated. EPA again sought input from stakeholders on the Plan. The Agency held a three-day focus group meeting with "external stakeholders" and a one-day meeting with states in September 1994, as well as a meeting with environmental groups in October 1994. EPA also announced the Plan and a draft methodology for setting waste minimization priorities in the Federal Register and invited public comment.

Today's Release: EPA's Waste Minimization National Plan

**National Waste Minimization Goals**

The National Plan addresses those constituents in hazardous waste, or compounds they degrade to, that pose potential threats to human health and the environment, because they are:

- **Persistent**, after they are released into the environment (i.e., they generally do not break down into other substances once they are released into the environment;

[3] Other goals of the 1993 Draft Strategy on Hazardous Waste Minimization and Combustion were: strengthening federal controls governing hazardous waste incinerators and boilers and industrial furnaces (BIFs); enhancing public participation at the time for and prior to permitting a facility; assessing multi-pathway risk at each combustion facility to be permitted and considering the assessment prior to making a permit decision; and ensuring that regulatory and permit requirements are vigorously enforced.

- **Bioaccumulative** i.e., they tend to accumulate in plant and animal tissues); and

- **Toxic**, thereby having the potential to harm the environment or adversely impact human health (e.g., cancer, reproductive, and mutagenic health effects).

The Plan presents three goals:

1) To reduce the amount and toxicity of the most persistent, bioaccumulative, and toxic constituents in hazardous wastes that are generated by 25 percent in the year 2000 and by 50 percent by the year 2005.

2) To avoid transferring persistent, bioaccumulative, and toxic constituents across environmental media.

3) To ensure continual improvement in reducing these constituents at their source whenever possible, or, when not possible, that they are recycled in an environmentally sound manner.

EPA intends for these goals to be achieved by states and generators working together. However, EPA does not expect that every generator will reduce the generation of constituents in wastes by the levels, or time periods specified in the goal;[4] rather, we expect the national goal to be reached on an aggregated basis.

**Implementation Roles**

Identifying the roles that stakeholders can play in implementing this Plan is essential to effecting meaningful waste reduction. Based on stakeholder comments, EPA has outlined suggested roles for generators, states, and EPA.

It should be noted that one of the major messages that EPA received from stakeholders in developing this Plan was that the approaches used to accomplish the objectives in the Plan should allow states and industry a great deal of flexibility. EPA recognizes that individual generators have the best information on which waste minimization alternatives are technically and economically feasible. (For specific examples of some generators' recent source reduction and recycling implementation successes, see Appendix B.) In addition, many states already

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[4] EPA will generally use 1991 as the baseline year in measuring national progress; however, EPA also believes that generators should be able to select a different base year for measuring their progress against their own goals and the national goal, to account for reductions they have already achieved.

have an effective framework and programs that are resulting in real reductions in hazardous wastes and emissions. This Plan serves as a basic framework from which to expand and does not preclude industry and states from setting their own priorities and goals, and measuring their own progress. Roles have been defined in recognition of these facts.

EPA encourages all generators of hazardous wastes containing persistent, bioaccumulative, and toxic constituents to set their own goals and target years for achieving their goals, and track their progress toward their goals. In addition, some generators began waste minimization activities many years ago and may wish to measure their progress relative to a different baseline year than 1991, the year EPA will use to measure the nation's progress. In setting their own priorities and implementing source reduction and recycling activities, we expect that generators will consider factors such as technical and economic feasibility, product stewardship, and community concerns.

States will contribute to achieving the national goal by establishing their own goals and priorities. EPA does not anticipate conflicts between the national goals and state-level goals.

EPA Headquarters will develop a screening tool that EPA Regions, states, and industry can apply as a point of departure in setting their own priorities. EPA will also apply this tool to develop a national list of priority constituents to assist states or generators that are unable to apply the screening tool themselves.

EPA will provide support to generators, states, and EPA Regions as they implement this Plan. In addition, in the event that generators and states do not make progress toward the goal over a certain timeframe, EPA will consider whether a greater federal role is needed.

**Plan Objectives**

EPA received many comments during stakeholder discussions and public review. The National Plan reflects careful consideration of all of these comments. Five key messages recurred as a common theme, and these have become the foundation and objectives of the National Plan.

This Plan outlines a combination of voluntary, regulatory and institutional mechanisms to achieve these five waste minimization objectives. These objectives and the actions EPA is taking to implement them are described below.

<u>Objective 1:</u> Develop a framework for setting national priorities; develop and distribute a flexible screening tool for identifying

priorities at individual facilities; identify constituents of concern.

Objective 2: Promote multimedia environmental benefits and prevent cross-media transfers.

Objective 3: Demonstrate a strong preference for source reduction; shift attention to the nation's hazardous waste generators to reduce hazardous waste generation at its source.

Objective 4: Clearly define and track measures of progress. Promote accountability for EPA, states, and industry.

Objective 5: Involve citizens in waste minimization implementation decisions.

EPA projects related to each objective that are already underway or that will be pursued in the future are discussed below. EPA also will explore the value of implementing other actions as described in Appendix C.

Objective 1: Develop a framework for setting national priorities; develop and distribute a flexible screening tool for identifying priorities at individual facilities; identify constituents of concern.

EPA will set priorities for source reduction and environmentally sound recycling based primarily on the inherent hazard of constituents and wastes. This approach is particularly effective in addressing multimedia risks that are "difficult to predict," such as those that could result from unexpected failures of waste management practices (e.g., combustion unit operation "upsets", landfill liner leaks, and transportation accidents) and from unexpected occupational exposures. This approach implies a broader role for source reduction and environmentally sound recycling, addressing "high-hazard" constituents regardless of how they ultimately are managed. It is consistent with the statutory language in RCRA and in the Pollution Prevention Act which strongly promotes source reduction over waste management.

At the same time, EPA recognizes that there may be situations where releases from industrial processes and waste management practices pose significant risks or hazards that could be addressed by promoting source reduction or environmentally sound recycling. This may include risks from constituents that are difficult to manage using certain practices (e.g., metals, which are not destroyed by combustion and remain potentially available to the environment). Consequently, the Agency also plans to examine, where appropriate, the hazard associated with, for example, Toxics Release Inventory (TRI) releases.

ACTIONS:

- **EPA will develop a screening tool and a list of high-priority constituents for source reduction and recycling.**

EPA's primary objective is to promote source reduction and environmentally sound recycling for persistent, bioaccumulative, and toxic constituents in wastes and releases. At the same time, EPA wants to provide flexibility to EPA Regions, states, and facilities. To this end, the Agency is developing a screening tool to help users set source reduction priorities. EPA plans to make the screening tool available (at least in draft) in 1995.

The screening tool will be based primarily on the inherent hazard of constituents, but will also be applicable to potential hazards posed by management practices. The core of this screening tool will be an assessment of the hazard of constituents based on their persistence, bioaccumulation, toxicity, and quantity (i.e., mass). The Agency will also consider including other multimedia factors as well, such as the potential for constituents to degrade stratospheric ozone or to lead to ground water contamination problems.

Although EPA is using this subset of factors in setting initial priorities on a national basis, this does not preclude generators, states, and EPA Regions from considering a variety of other relevant factors in establishing their specific priorities. States and industry are likely to possess much more detailed information on the risks posed by wastes and releases (e.g., information on surrounding populations or sensitive ecosystems that may be exposed to releases of constituents) and can adjust their priorities accordingly. EPA Regions and States may have other concerns as well (e.g., environmental justice and waste management capacity) that would be factored into their priorities.

To establish initial national priorities and to assist states or facilities that cannot apply the screening tool themselves, EPA plans to develop an initial list of high-priority constituents for source reduction and recycling from a national perspective.

- **EPA will use the results from the prototype screening approach to set priorities for metals.**

EPA has developed a prototype screening tool addressing metals in hazardous wastes that are combusted. The screening tool is based largely on the draft methodology described in Setting Priorities for Hazardous Waste Minimization (July 1994), with some important modifications. (See the Addendum to this National Plan for further details on the approach and results.)

Objective 2: Promote multimedia environmental benefits and prevent cross-media transfers.

In the Pollution Prevention Act of 1990, Congress made it clear that pollution prevention must be implemented in a multimedia framework, even though most environmental statutes are media specific. The goals in this National Plan are structured to address this concern. For example, the goals are stated in terms of reductions of specific constituents within wastes, rather than reductions of hazardous wastes as a whole. As a result, achieving the goal should create benefits for preventing pollution to all media.

**ACTION:**

- **EPA will propose guidance to encourage the implementation of multimedia pollution prevention programs at all facilities.**

One of the strongest messages from stakeholders in response to EPA's Draft Waste Minimization National Plan and Guidance to Hazardous Waste Generators on the Elements of a Waste Minimization Program in Place was that pollution prevention planning efforts are often not coordinated across media. This occurs both within companies, where different departments may have responsibility for different media pollution control programs, and between EPA or state offices and a particular company, where different offices encourage pollution prevention planning without fully incorporating cross-media impacts. Often, this results in duplicative, time-consuming, and sometimes counterproductive efforts.

As a first step toward meeting this objective, EPA will expand the scope of its Guidance to Hazardous Waste Generators on the Elements of a Waste Minimization Program in Place to encourage implementation of multimedia pollution prevention programs at all facilities. EPA will work closely with all states, particularly those that have moved forward on multimedia pollution prevention and permitting programs, since these states' programs may serve as useful models for the future.

Objective 3: Demonstrate a strong preference for source reduction; shift attention to the nation's hazardous waste generators to reduce hazardous waste generation at its source.

In the past, the primary emphasis was placed on ensuring the safe management of hazardous wastes once they were generated. The 1984 amendments to RCRA initiated a shift in focus toward the generation of the waste, requiring generators to certify that they have a "program in place" to reduce the volume and toxicity of their hazardous wastes.[5]

The National Plan continues this shift of attention toward pollution prevention and hazardous waste generators. Action items that encourage generators to implement waste minimization programs are discussed below.

ACTIONS:

♦ **EPA will implement several VOLUNTARY MECHANISMS, including:**

**1) Promote focused technical assistance to small- and medium- sized generators of constituents of concern.**

EPA entered into a cooperative agreement with the National Pollution Prevention Roundtable (NPPR) to develop a strategy for providing technical assistance to generators of high-priority constituents. Over 120 state and local pollution prevention technical assistance centers across the country assist thousands of waste generators each year. The centers help generators identify cost-effective waste reduction methods, thereby helping them to rely less on costly waste management. EPA will work with the NPPR during 1995 to implement and expand this strategy.

**2) Developing outreach and communication mechanisms.**

EPA will develop pollution prevention technical guidance manuals for selected industrial sectors or processes generating high-priority constituents. The technical guidance manuals will examine source reduction and environmentally sound recycling alternatives and assess the technical/economic feasibility and potential environmental impacts of each alternative. EPA will set up mechanisms to disseminate this information to regulators, technical assistance centers, and other stakeholders. In addition, the Agency will prepare a document that identifies promising research underway to reduce generation of priority constituents.

**3) Providing guidance to states on incorporating waste minimization in hazardous waste management planning.**

Section 104 (c) (9) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires

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[5] Large quantity generators must certify that they have a "program in place" on manifests when they ship their wastes off-site (§ 3002(b)); generators who also treat, store, or dispose of their wastes on-site must certify that they have a "program in place" (§ 3005(h)). Small quantity generators must certify when they ship their wastes off-site, but they certify that they are making a "good faith effort" to reduce their wastes.

states to assure that adequate capacity exists to manage hazardous wastes generated over a 20-year period. Failure to provide this assurance results in denial of Superfund Trust fund money for remedial actions. To make this showing, EPA has asked states to submit Capacity Assurance Plans (CAPs) that demonstrate the state's understanding of current in-state hazardous waste management, and to develop plans for future management of hazardous waste.

EPA plans to release a draft waste minimization guidance document in 1995 to aid states in developing the waste minimization component of hazardous waste management planning efforts. The guidance will emphasize flexibility in state planning of waste minimization activities and cover: data sources and methods for setting priorities; making projections of future reductions, and measuring progress; barriers and incentives to increased use of waste minimization; and state program and generator success stories. The CAP program will incorporate comments from states on the draft document, and also plans to make some grant funding available to states for this voluntary effort.

- **EPA will implement several mechanisms within the RCRA REGULATORY framework, including:**

**1) Developing a program for working with generators to promote waste minimization**

While many companies have made significant progress in waste minimization over the past ten years, quantitative and anecdotal data indicate that there are still many companies who have not taken advantage of the potential hazard reduction and cost savings benefits of waste minimization planning. Consequently, EPA's Offices of Solid Waste and Enforcement and Compliance Assurance will develop during 1995 a program which identifies how to work with generators that will encourage waste minimization progress. For example, EPA believes that generators who ship wastes that are identified as high-priority off-site for treatment, storage or disposal, and generators who manage their wastes on-site could complete an analysis of cost effective waste minimization options. EPA will work with these companies to encourage completion of such on analysis. EPA will emphasize flexibility in conducting such analysis. In 1995, EPA and the States will develop and begin implementing an action specific plan to enable this to take place.

**2) Issuing revised guidance on the use of Supplemental Environmental Projects (SEPs).**

The revised policy will provide greater ease to Regions and states in constructing viable SEPs as a tool in negotiating enforcement settlements. This document will provide better guidance on appropriate circumstances for their use, as well as clarifying activities that qualify for inclusion in a SEP. This guidance will be issued in 1995.

3) **Working with EPA Regions and states to provide waste minimization training for inspectors, permit writers and enforcement officials.**

Many facility stakeholders have expressed concern that inspectors, permit writers, and enforcement officials do not adequately understand waste minimization principles from a production process perspective. To remedy this situation, EPA is developing a national handbook and training course on the principles of waste minimization. This training is designed for inspectors, who must verify that generators have certified that they have a waste minimization program in place, for RCRA permit writers, who promote waste minimization conditions in RCRA permits, and for enforcement officials, who assist in promoting waste minimization through (SEPs). Several EPA Regions and states have waste minimization training programs available, and many others have expressed strong interest in establishing one. The handbook and training course will build on the waste minimization inspection programs currently used in EPA Regions and states, and will network existing training capability in Regions and states to incorporate waste minimization principles into inspection, permit writing, and enforcement functions. The handbook and training curriculum will be developed completed in 1995.

- **EPA will implement several INSTITUTIONAL MECHANISMS, that will allow the RCRA program to be implemented so as to encourage the EPA Regional Offices and State environmental agencies to facilitate generators' waste minimization actions, including:**

1) **Incorporating the goals developed in the National Plan into the RCRA Implementation Plan (RIP)**

Both Regions and states use the RIP to focus their RCRA program activities each fiscal year. The RIP designates national RCRA priorities for the year and outlines expectations that EPA Headquarters places on priority actions to be implemented by Regions and states. For example, in the Fiscal Year 1995 RIP, EPA outlined a process by which Regions and states could identify generators of hazardous wastes going to combustion units and use a variety of tools to encourage these generators to pursue further waste minimization activities. EPA intends to incorporate the national goals presented in this Plan into the RIP for Fiscal Year 1996 and following years. The RIP will be the primary vehicle for setting EPA's expectations for state hazardous waste programs to accomplish the national goal, along with accountability measures for states and Regions to show their progress in meeting the national goal (see below).

2) **Developing accountability measures and incentives for the Regions and states to promote accomplishments toward achieving the national goals.**

Under the current hazardous waste program implementation scheme, there are few incentives for EPA Regions and states to focus their attention on hazardous waste generators. Most program activities focus on the treatment, storage, and disposal facilities managing the hazardous waste that is generated. Accountability measures, which EPA Headquarters uses to track the implementation actions of states and Regions, typically focus on treatment, storage and disposal facilities. In revising the scheme of accountability measures, EPA intends to put a heavier focus on hazardous waste generators. EPA is working to develop a revised scheme for the fiscal years following 1995.

<u>Objective 4: Clearly define and track measures of progress. Promote accountability for EPA, states, and industry.</u>

**<u>ACTION:</u>**

- **EPA will identify necessary data to evaluate progress in reducing the most persistent, bioaccumulative, and toxic constituents**

To avoid information collection and processing burdens, EPA will explore using existing data sources to evaluate national progress toward the goal. Databases exist that contain information on hazardous waste quantities and how they are managed (the "BRS" database), and on how toxic chemicals are released to the environment or are managed (the "TRI" database). EPA is reassessing the ability of these and other hazardous waste information databases (e.g., state databases) for measuring progress in waste minimization, through the "Measurement Pilot Projects". EPA has sponsored these Pilot Projects with four states. Each state will submit to EPA state-level evaluations and recommendations about collecting data to measure waste minimization progress. EPA will receive those states' recommendations in Fall/Winter 1994.[6] In addition, EPA is taking a comprehensive look at waste information needs, including data needed to measure waste minimization.

<u>Objective 5: Involve citizens in waste minimization implementation decisions.</u>

**<u>ACTIONS:</u>**

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[6] The four states are Alaska, Ohio, Oregon, and Washington.

♦ **EPA will continue to encourage generators of hazardous wastes to share waste minimization priorities and initiatives, and be accountable to the public.**

As part of the Biennial Report, EPA has just published a list of large quantity generators of hazardous waste (using 1991 data), that were required to certify that they had a Waste Minimization Program in Place. By putting this information up on the Internet and the RTKNet, EPA expects that the list will reach a much wider audience than has been possible using only paper publications. This information is one tool for the general public to use in better understanding the source reduction and environmentally sound recycling efforts of hazardous waste generators. Members of the general public who are most directly affected by hazardous waste can also become more familiar with hazardous waste generation patterns as a result of publication of this list. The publication of the list also will enable them to pursue further sources of information.

♦ **EPA will publish guidance to Regions, states, and industry, identifying when and how waste minimization information should be made available to the public during the permit process.**

EPA is planning to publish a final rule in the summer of 1995 on "RCRA Expanded Public Participation and Revisions to Combustion Permitting Procedures" (see June 2, 1994 proposal, published at 59 FR 28680). In addition to the final rule, EPA plans to develop guidance, in fall 1995, that focuses specifically on § 124, Subpart B of RCRA procedures applicable to RCRA permits. This guidance reflects EPA's desire for the public to understand and comment on waste minimization.

This guidance to EPA Regions and states will include information such as:

- Procedures for highlighting pollution prevention information in any public notices.
- Instructing permit writers to acquire facility-specific waste minimization information and make it available to the public. Facility specific information that may be highlighted includes:

  - Historical TRI information for facilities in question, (highlighting chemical generation, recycling, treatment, transfers and releases, and pollution prevention activity).
  - Historical Biennial Report data, highlighting waste generation, waste management, and waste minimization activities.
  - Any previous 3002(b) or 3005(h) waste minimization program in place certifications signed by facilities and any publicly available non-CBI

supporting documentation facilities may have on file.

- A summary of any State or local pollution prevention requirements (e.g., requirements for pollution prevention facility plans), and a copy of facility-specific publicly available documentation (e.g., a facility-specific pollution prevention facility plan).
- A list of technical assistance contacts that have information on pollution prevention opportunities.
- Pollution prevention contacts at facilities.
- Procedures for arranging pollution prevention meetings with facilities if citizens identify this as a need.

## Appendix A - Definitions of Terms

In this document, EPA is using terms such as "waste minimization," "source reduction," "recycling," "environmentally sound recycling," and "pollution prevention." There has been and continues to be much debate over what activities can be classified as waste minimization, for example, or as source reduction.

For the purposes of the RCRA Waste Minimization National Plan, EPA is reiterating its previous explanation, published in the May 28, 1993 Federal Register at 58 FR 31115, which explained and defined these terms as follows:

> EPA believes that waste minimization, the term employed by Congress in the RCRA statute, includes (1) source reduction, and (2) environmentally sound recycling. (See later discussion for further clarification of which types of recycling are not waste minimization.)
>
> The first category, source reduction, is defined in section 6603(5)(A) of the Pollution Prevention Act, 42 U.S.C. 13102(5)(a), as any practice which (i) reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and (ii) [r]educes the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.
>
> The term includes equipment or technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control.
>
> EPA believes this definition is appropriate for use in identifying opportunities for source reduction under RCRA.
>
> The second category, environmentally sound recycling, is the next preferred alternative for managing those pollutants which cannot be reduced at the source. In the context of hazardous waste management, there are certain practices or activities which the hazardous waste regulations define as "recycling." The definitions for materials that are "recycled" are found in Title 40 of the Code of Federal Regulations, § 261.1(c). A "recycled" material is one which is used, reused, or reclaimed.[7] A material is "used or reused" if it is (i) employed as an

[7] 40 CFR 261.1(c)(7).

ingredient (including use as an intermediate) in an industrial process to make a product (for example, distillation bottoms from one process used as feedstock in another process)* * * or (ii) employed in a particular function or application as an effective substitute for a commercial product.* * *[8]

A material is "reclaimed" if it is "processed to recover a usable product, or if it is regenerated."[9]

Some readers of [the May 28, 1993 Federal Register notice] may question whether certain types of recycling are within the concept of waste minimization. EPA believes that recycling activities closely resembling conventional waste management activities do not constitute waste minimization.

Transfer of hazardous constituents from one environmental medium to another also does not constitute waste minimization. For example, the use of an air stripper to evaporate volatile organic constituents from an aqueous waste only shifts the contaminant from water to air. Furthermore, concentration activities conducted solely for reducing volume does not constitute waste minimization unless, for example, concentration of the waste is an integral setup in the recovery of useful constituents prior to treatment and disposal. Similarly, dilution as a means of toxicity reduction would not be considered waste minimization, unless dilution is a necessary step in a recovery or a recycling operation.

Several questions have been raised regarding whether EPA considers burning a hazardous waste for energy recovery a form of recycling that is "waste minimization." As stated in the May 23, 1994 Draft RCRA Waste Minimization National Plan (p.2) and in the RCRA/Superfund Hotline Monthly Report for July 1994, EPA does not consider burning hazardous wastes for energy recovery to be "waste minimization." Burning the hazardous waste for its energy value closely resembles incineration, a conventional waste management activity, because in both burning for energy recovery and in incineration, constituents are either destroyed by the burning process or are emitted into the air.

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[8] 40 CFR 261.1(c)(5).

[9] 40 CFR 261.1(c)(4).

## Appendix B - Examples of Successful Waste Minimization Actions

Described below are examples of seven hazardous waste generators' waste minimization activities; these examples outline process and waste information, results, and cost savings the generators achieved.

**1.0 HEADLINE:** Raw Material Substitution and Process Modification at an Electronic Component Manufacturing Facility

**2.0 SIC CODE:** Electronic Components & Accessories/SIC 3674

**3.0 NAME & LOCATION OF COMPANY:** Siltec Silicon; 1351 Tandem Avenue N.E.; Salem, OR 97303; Murray McCareary, 503/371-0041

**4.0 CASE STUDY SUMMARY:**

**4.1 Pollution Prevention Program Description:**

Siltec, a 600 employee company, recently adopted a total quality management (TQM) approach to doing business. Among the benefits of this approach, Siltec has been able to continuously improve its environmental quality program. Siltec's Board of Directors and shareholders approved a resolution to make safety and environmental projects first priority when making decisions about capital investments and projects.

Siltec established priorities, plans, and goals around four major themes:

- Reducing or eliminating the use of toxic substances;
- Minimizing or eliminating the generation of hazardous wastes;
- Practicing resource conservation; and
- Establishing strong internal environmental systems to ensure ongoing prevention and protection.

Siltec's first goal was to completely eliminate use of chlorofluorocarbons (CFCs) and Halons. The second goal was to eliminate the use of 1,1,1-trichloroethane (TCA) and trichloroethylene (TCE). Subsequent goals addressed eliminating acetone, ammonium hydroxide, hydrogen peroxide, and chromic acid. In general, Siltec viewed those chemicals being used in the greatest volume as the best opportunities for waste reduction.

After investigating immediate waste reduction opportunities based on chemical inputs, Siltec addressed waste reduction opportunities based on energy and water conservation and recycling.

**4.2 Process & Waste Information:**

TCE and TCA were used in the production processes to remove wax from process equipment. By changing the wax used and utilizing an industrial wax stripper in combination with hot caustic, the need for both solvents was eliminated. The replacement chemicals are commonly used and present a low degree of environmental hazard. Fire fighting Halon-based systems were replaced with water sprinklers and carbon dioxide or dry chemical fire extinguisher.

Acetone presented employees with an unacceptable safety hazard. Through careful study and trials, Siltec identified isopropyl alcohol as an acceptable substitute. Looking to subsequently minimize the generation of waste isopropyl alcohol, Siltec purchased two industrial boilers that could be fueled by alcohol or natural gas. The alcohol, whose use is being phased out completely, will be used to fire the boilers. Once the alcohol is eliminated, the boilers will be fired with natural gas.

Ammonium hydroxide and hydrogen peroxide were eliminated from process operations through modification of the process operations. These changes resulted in reduced material purchasing and handling, simplified storage, and lower waste treatment and related costs.

Chromic acid is used in an etching process. Process modifications have resulted in substantially reduced waste chromic acid. However, an acceptable alternative that will eliminate the use of chromic acid is still being sought.

Siltec has implemented several recycling and recovery programs:

- waste process heat recovery;
- water conservation;
- paper recycling;
- scrap "poly" recycling;
- shipping pallet reuse;
- scrap metal recycling; and
- used drum reuse.

**4.3 Scale of Operation:** Facility wide

**4.4 State of Development:** Fully implemented

**4.5 Level of Commercialization:** Techniques and measures are broadly applicable across other industrial sectors utilizing comparable technologies and processes.

**4.6 Balances & Substitutions:**

| CHEMICAL/ RESOURCE | UNITS OF MEASURE | 1989-1990 USAGE | 1990-1991 USAGE | REDUCTION | ANNUAL SAVINGS ($) |
|---|---|---|---|---|---|
| Freon TF | Pounds | 73,815 | 0 | 100% | 129,501 |
| Freon 23 | Cylinders | 1 | 0 | 100% | 1,679 |
| Freon 116 | Cylinders | 2 | 0 | 100% | 2,725 |
| Trichloroethane | Pounds | 432 | 0 | 100% | 695 |
| Trichloroethylene | Pounds | 18,937 | 0 | 100% | 11,174 |
| Acetone | Gallons | 100 | 0 | 100% | 610 |
| Ammonium Hydroxide | Pounds | 562,703 | 435,893 | 23% | 95,340 |
| Hydrogen Peroxide | Pounds | 923,696 | 610,916 | 34% | 203,660 |
| Isopropyl Alcohol | Gallons | 11,064 | 0[10] | 100% | NA |
| Chromic Acid Waste | Gallons | 8,721 | 5,967 | 32% | 2,052 |
| Heat Energy | KWH/yr | NA | NA | 175,900/yr | NA |
| Water | NA | NA | NA | 12-15% | NA |
| Waste Paper | Pounds | NA | NA | 29,000/yr | NA |
| Scrap Poly | Pounds | NA | NA | 255,000/yr | NA |
| Empty Drums | Drums | NA | NA | 20/week | NA |

NA = Not Available

## 5.0 ECONOMICS:

Less than $150,000 has been spent for process changes and opportunity assessments. Labor costs have not been carefully monitored and instead have been absorbed into general overhead costs.

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[10] The isopropyl alcohol has been converted to a fuel. In 1991, Siltec used 11,420 gallons of isopropyl alcohol.

In 1989, Siltec instituted a five-year pro-active environmental effort to upgrade all existing facilities and systems. As of 1992, over $9 million have been invested towards completion of this plan.

Costs savings due to particular measures are described in Section 4.0

**6.0 DATE CASE STUDY WAS PERFORMED:** 1992

**7.0 CONTACTS & CITATION**

Commendation, Second Annual Oregon Governor's Award for Toxics Use Reduction, 1992

Oregon Waste Reduction Assistance Program
Oregon Department of Environmental Quality
811 S.W. Sixth Avenue
Portland, OR 97204

Sandy Gurkewitz -- 503/229-5918, Department of Environmental Quality

**1.0 HEADLINE:** Process Modification and Material Substitution at a Steel Mill

**2.0 SIC CODE:** Primary Metals/SIC 3312

**3.0 NAME & LOCATION OF COMPANY:** Oregon Steel Mills; 1000 S.W. Broadway, Suite 2200; Portland, OR 97205; Mark Rowsell, 503/223-9228

**4.0 CASE STUDY SUMMARY:**

**4.1 Pollution Prevention Program Description:**

Oregon Steel Mills, Inc. (OSM) is committed to environmental improvements in their procedures and practices as is evidenced by their Corporate Environmental Policy Statement. The goal is to reduce air emissions, toxics use, and hazardous waste generation, and incorporate recycling activities into operations. As part of the company's commitment, they joined EPA's 33/50 program in 1989. Under this program, OSM will attempt to reduce hazardous waste generation by 33 percent by the end of 1993 and by 100 percent by 1995.

This policy applies to all facilities owned and operated by OSM, but each facility has also developed site-specific policies as well as employee involvement in waste reduction programs. OSM established an Environmental Committee to address all issues and review all chemical and equipment purchases and any process changes. In 1992, OSM implemented a hazardous materials tracking system enabling them to track materials from purchase to disposal. This allows the Environmental Committee to identify and implement ongoing toxic use and waste reduction programs throughout their operations.

**4.2 Process & Waste Information:**

OSM uses an electric arc furnace that produces a dust that is a listed hazardous waste (K061). OSM developed a glass manufacturing technology known as Glassification ™, which recycles this dust along with other materials to make a commercial glass product. The result is complete elimination of the hazardous waste. Approximately 7,000 tons per year of the dust is reused in the glass production in addition to the conservation of natural resources (e.g., iron ore), which is normally required in the glass production.

Another effort of OSM involved changing from atomizing to non-atomizing nozzles in their paint spray equipment. This change resulted in a 15 percent reduction in paint waste residues and allowed the use of a paint that is lower in solvents.

In 1992, OSM voluntarily eliminated PCBs from its plant by replacing three PCB-containing transformers with non-PCB transformers. The company also replaced their chromium refractory brick with the Dolometic type used for lining ladles. The inert materials from non-chromium bricks pose little harm to the environment by reducing exposure to chromium particulates and contain no leachable constituents.

**4.3 Scale of Operation:** Facility-wide

**4.4 State of Development:** Fully implemented

**4.5 Level of Commercialization:** Techniques and measures are broadly applicable across other industrial sectors utilizing comparable technologies and processes. OSM predicts that within the next few years, nationwide use of Glassification ™ will eliminate 250,000 tons of hazardous waste from treatment or land disposal.

**4.6 Balances & Substitutions:**

| CHEMICAL/ RESOURCE | UNITS OF MEASURE | 1993 USAGE | 1994 USAGE | REDUCTION | ANNUAL SAVINGS ($) |
|---|---|---|---|---|---|
| K061 | Tons | 7,000 | 7,000 | 100% recycled | NA |
| PCB oils | Gallons | 4,000 | 0 | 100% | NA |
| chromium refractory bricks | Bricks | 400,000 | 0 | 100% | NA |

NA = Not Available

**5.0 ECONOMICS:**

An estimated revenue of $6,384,000 per year should yield an approximate 4 year pay back for the Glassification ™ process. An additional savings of $1,820,000 results from decreased disposal costs.

Elimination of chromium refractory bricks resulted in a financial savings of $2,300,000 per year in purchasing costs. Additional savings from hazardous waste disposal, transportation, and handling costs were not estimated.

By eliminating all PCBs from the facility, OSM reduced future financial and environmental liabilities.

**6.0 DATE CASE STUDY WAS PERFORMED:** 1992

## 7.0 CONTACTS & CITATION

Winner, Oregon Governor's Award for Toxics Use Reduction, 1993.

Oregon Waste Reduction Assistance Program
Oregon Department of Environmental Quality
811 S.W. Sixth Avenue
Portland, OR 97204

Sandy Gurkewitz -- 503/229-5918, Department of Environmental Quality

**1.0 HEADLINE:** Material Substitution and Process Change at a Trucking Company

**2.0 SIC CODE:** Trucking/SIC 42

**3.0 NAME & LOCATION OF COMPANY:** Consolidated Freightways; P.O. Box 3420; Portland, OR 97208; Larry Stub, 503/499-3281

**4.0 CASE STUDY SUMMARY:**

**4.1 Pollution Prevention Program Description:**

The Portland shops of Consolidated Freightways Motor Freight have formed a Hazardous Waste Reduction Committee made up of all levels of personnel. The responsibilities of the Committee include studying, testing, and recommending substitute chemicals and processes for hazardous waste streams at these facilities. They also provide training and help personnel as they adjust to new chemicals or processes. The Committee implemented a materials substitution in the company's dust abatement equipment in an effort to reduce hazardous waste.

**4.2 Process & Waste Information:**

The company used dust abatement equipment when performing brake relining on their vehicles. Use of water soluble chemicals eliminated the need for stoddard solvent. This new process only required building new pumping units to hold the liquid for this process, but resulted in a reduction of 631 pounds per week in the production of hazardous waste. In addition, this has reduced employee exposure to stoddard solvent along with reducing the amount of waste to dispose.

**4.3 Scale of Operation:** Facility-wide

**4.4 State of Development:** Fully implemented

**4.5 Level of Commercialization:** Techniques and measures are broadly applicable within the automotive/trucking industries.

**5.0 ECONOMICS:**

An initial investment of $6,000 was required to build and implement the new equipment. A cost savings of approximately $7,400 per year resulted in a payback period of less than one year.

**6.0 DATE CASE STUDY WAS PERFORMED:** 1991

**7.0 CONTACTS & CITATION**

Co-winner, Oregon Governor's Award for Toxics Use Reduction, 1991.

Oregon Waste Reduction Assistance Program
Oregon Department of Environmental Quality

811 S.W. Sixth Avenue
Portland, OR 97204

Sandy Gurkewitz -- 503/229-5918, Department of Environmental Quality

**1.0 HEADLINE:** Process Modification at an Electronic Component Manufacturing Facility

**2.0 SIC CODE:** Electronic Components & Accessories/SIC 3674

**3.0 NAME & LOCATION OF COMPANY:** Intel Corporation; 5200 NE Elam Young Parkway; Hillsboro, OR; John Harland, 503/642-6479

**4.0 CASE STUDY SUMMARY:**

**4.1 Pollution Prevention Program Description:**

Intel Corporation is committed pollution prevention which has been institutionalized and made a goal at all levels of the company. Intel has established priorities, plans, and goals that include:

- Eliminating the use of CFCs by 1992;
- Tieing executive bonuses to environmental performance;
- Creating the Environmental, Health, and Safety Department (EHS);
- Committing to reduce chemical volumes and toxicity with each new process;
- Requiring EHS approval for all new chemical purchases;
- Requiring EHS approval for all process equipment installations;
- Recognizing individual employees and Divisions for toxic use reduction;
- Participating in the EPA 33/50 program; and
- Providing approximately 3,720 hours of EHS training (1991).

This commitment is seen through four projects which Intel completed in 1991. These projects resulted in major reductions in chemical use and waste generation.

**4.2 Process & Waste Information:**

(1) Attaching components to printed circuit boards using sophisticated surface mount technology required use of CFCs. Intel decided to redesign the process so the use of CFCs was completely eliminated. The new design uses water soluble surface mount pastes, fluxes, and final assembly techniques. All chemical cleaning steps have been removed and only hot water is used where cleaning is required. Over 75,000 lbs/yr of ozone depleting Freon 113 were eliminated and greater efficiency allowed the process to expand operations to 24 hours a day.

(2) Acetone is used to clean photoresist application equipment. By installing controls that allow variable volume and frequency dispensing rather than automatic dispensing, consumption was reduced by 60,000 lbs/yr (30 percent). Less chemicals are handled and fewer air emissions occur.

(3) An innovative filtration process was installed that reduced sulfuric acid consumption by 9,400 lbs/yr (43 percent) while also improving acid purity and increasing product yield.

(4) Wastewater laden with phosphates results from phosphoric acid used in the manufacturing process. In an attempt to avoid contributing phosphates to a nearby river, Intel researched alternative manufacturing methods. After determining that consumption of phosphoric acid could not be sufficiently reduced and all wastewater treatment options involved the use of more chemicals, Intel began searching for a use for the used phosphoric acid. As a result 100,000 gallons per year of phosphoric acid that previously was managed as a waste is collected and sold for use by fertilizer manufacturers. No phosphate waste is generated, reducing the phosphate load to the river by 18%. In addition, Intel stopped using 120,000 lbs/yr of caustic to treat the waste.

**4.3 Scale of Operation:** Facility-wide

**4.4 State of Development:** Fully implemented

**4.5 Level of Commercialization:** Techniques and measures are generally applicable to other electronic manufacturers and other industrial sectors utilizing comparable technologies and processes.

**4.6 Balances & Substitutions:**

| CHEMICAL/ RESOURCE | UNITS OF MEASURE | 1990 USAGE | 1991 USAGE | REDUCTION | ANNUAL SAVINGS ($) |
|---|---|---|---|---|---|
| Freon 113 | Pounds | 75,000 | 0 | 100% | 140,000 |
| Acetone | Pounds | 200,000 | 140,000 | 30% | NA |
| Sulfuric acid | Pounds | 21,850 | 12,450 | 43% | NA |
| Phosphate | Gallons | 100,000 | 0 | 100% | 160,000 |
| Caustic | Pounds | 120,000 | 0 | 100% | 12,000 |

NA = Not Available

## 5.0 ECONOMICS:

An estimated $2.2 million was spent for process changes and research in order to put the four projects in place. This translates to 0.121 lbs of toxic use reduction per year per dollar spent and 0.461 lbs of waste prevented per year per dollar spent.

The payback period is unclear, however through reductions in disposal costs, purchase costs, and environmental liability, a payback of the initial investment will be realized.

## 6.0 Date Case Study was Performed: 1992

## 7.0 Contacts & Citation

Winner, Second Annual Oregon Governor's Award for Toxics Use Reduction, 1992.

Oregon Waste Reduction Assistance Program
Oregon Department of Environmental Quality
811 S.W. Sixth Avenue
Portland, OR 97204

Sandy Gurkewitz -- 503/229-5918

1.0 **HEADLINE:** Process Modification at a Liquid and Solid Propellant Propulsion Systems Manufacturer

2.0 **SIC CODE:** Fabricated Metal Products/SIC 34

3.0 **NAME & LOCATION OF COMPANY:** Aerojet Propulsion Division; Sacramento, CA 95813; Keith Pearce

4.0 **CASE STUDY SUMMARY:**

**4.1 Pollution Prevention Program Description:**

Aerojet Propulsion Division, a 3,300 employee company, has implemented a Waste Reduction Program. The three person staff assists in identifying and implementing waste reduction projects wherever possible.

Aerojet identified three categories as drivers for waste reduction:

- Inventory reporting;
- Emission reporting; and
- Employee exposure.

In July 1987, a vapor degreasing pollution prevention project was implemented in anticipation of solvent use restrictions along with concerns over employee exposure. Since that time, the cost of halogenated hydrocarbon solvent has also provided a compelling reason for change.

**4.2 Process & Waste Information:**

In producing its propulsion systems, Aerojet uses several processes to clean metal parts for the liquid propellant engines (e.g., a bonding process). Water soluble machine tool coolant is the primary contaminant being removed. Two vapor degreasers were used that did a good job of removing contaminants, but a large amount of energy was required and 80% of the perchloroethylene and 100% of the Freon were lost to the atmosphere.

An emulsion cleaning system was adopted and has proven to be beneficial from both an environmental and economic view. No incinerable waste is produced by this cleaning process and hydro testing of hardware after cleaning no longer results in generation of hazardous waste.

**4.3 Scale of Operation:** Facility-wide

**4.4 State of Development:** Fully implemented

**4.5 Level of Commercialization:** Fully applicable to comparable parts cleaning operations

### 4.6 Balances & Substitutions:

| CHEMICAL/ RESOURCE | UNITS OF MEASURE | 1987 USAGE | 1988 USAGE | REDUCTION | ANNUAL SAVINGS ($) |
|---|---|---|---|---|---|
| Freon 113 | Tons | 69 | 0 | 100% | $195,000 from the process change |
| Perchloroethylene | Tons | 102 | 0 | 100% | |

### 5.0 ECONOMICS:

The purchase and installation of the new emulsion cleaning system was $300,000. Removal of the old equipment cost $100,000. The annual operating and maintenance costs for the new system are $72,000, resulting in an annual savings of $203,000 from the reduced operating costs of the previous system.

A payback period of 1.5 years for the initial capital was determined based on the fact that some of the existing equipment was to be replaced at a cost of $110,000. This cost was avoided with the installation of the new system. Many intangible benefits from the reduction in waste are not quantified.

### 6.0 DATE CASE STUDY WAS PERFORMED: 1991

### 7.0 CONTACTS & CITATION

California Incinerable Hazardous Waste Minimization Workshops, 1991

Aerojet Propulsion Division
Sacramento, CA 95813

Keith Pearce, Aerojet

**1.0 HEADLINE:** Reduced Raw Material Use and Process Modification at a Stainless Steel Manufacturing Facility

**2.0 SIC CODE:** Stainless Steel Manufacturing/SIC 33

**3.0 NAME & LOCATION OF COMPANY:** Carpenter Technology Corporation; Reading, PA. Michael Wise, Manager, Environmental Engineering. 610/208-2570

**4.0 CASE STUDY SUMMARY:**

**4.1 Pollution Prevention Program Description:**

Carpenter Technology Corporation manufactures stainless steel for customers in the medical, aerospace, and oil drilling industries. Some of the chemicals used in the steel manufacturing facility are acid and solvents, including 1,1,1-trichloroethane (TCA), mineral spirits, and perchloroethylene (PERC). Acid is used in the manufacturing process to pickle the steel and various organic solvents are used to degrease the stainless steel.

TCA is known for its ozone depleting properties. PERC was listed as a potential cancer causing agent in the 1980s. Due to this, Carpenter Technology decided to adjust a number of their processes to reduce raw material usage, which resulted in decreased raw material purchases and waste disposal costs. Their goal is to eliminate TCA usage.

**4.2 Process & Waste Information:**

Carpenter Technology Corporation implemented the following pollution prevention measures:

1. Instead of routinely disposing of acid baths, acid solutions are tested by chemical titration and stabilized. Acids are only disposed when determined to be unusable.

2. Substitution of mineral spirits in most of the parts washing stations.

3. Closing of containers when not in use decreased TCA consumption by 95 percent.

4. Two large PERC degreasers had to be retained, but they were modified to reduce emissions of volatile organic compounds.

5. Coolant wastes were reduced by prolonging coolant life through relatively simple laboratory tests to control additions of coolant and chemicals.

**4.3 Scale of Operation:** Facility-wide

**4.4 State of Development:** Fully implemented

**4.5 Level of Commercialization:** Fully applicable to industries employing similar processes.

### 4.6 Balances & Substitutions:

| CHEMICAL/ RESOURCE | UNITS OF MEASURE | 1991 USAGE | 1992 USAGE | REDUCTION | ANNUAL SAVINGS ($) |
|---|---|---|---|---|---|
| Acid | Pounds | 3,000,000 | NA | NA | NA |
| 1,1,1 TCA | Gallons | 25,000 | 1,600 | 94% | NA |
| Coolant | Gallons | NA | NA | NA | NA |

NA = Not Available

### 5.0 ECONOMICS:

Between $150,000 and $200,000 were spent to develop and implement all of the changes. In addition, annual operating costs will be approximately $150,000 and $200,000. A savings of over $1.5 million per year is realized by avoiding the cost of solvents and acid purchases, hazardous waste disposal, and coolant disposal. Benefits with no assigned dollar value include the decreased risk of environmental liability, increased employee safety, and ease in complying with additional environmental regulations.

### 6.0 DATE CASE STUDY WAS PERFORMED: 1993

### 7.0 CONTACTS & CITATION

Winner, Pennsylvania Governor's Waste Minimization Award Program, 1993.

Pennsylvania Department of Environmental Resources
Source Reduction Section
P.O Box 8472
Harrisburg, PA 17105-8472

Meredith Hill -- 717/787-7382, Pennsylvania Department of Environmental Resources

1.0 **HEADLINE:** Safety-Kleen Customers Minimize Waste Solvent Volumes

2.0 **SIC CODE:** 4953

3.0 **NAME & LOCATION OF COMPANY:** Safety-Kleen
1000 North Randall Road
Elgin, IL 60123-7857

4.0 **CASE STUDY SUMMARY:**

**4.1 Pollution Prevention Program Description:**

In 1994, Safety-Kleen Corp. introduced a waste minimization parts cleaning machine for its customers who use degreasing solvents to clean dirty metal parts used in automotive and industrial businesses. This new system will introduce an environmentally improved solvent which will allow tens of thousands of mostly small businesses to maintain the same level of cleaning while reducing solvent use by 12 million gallons a year. This reduced volume of solvent will be recycled and reused in a closed loop process.

**4.2 Process & Waste Information:**

The new parts cleaning machine which the firm calls the "Green Machine," includes a cyclonic separation system which more than doubles the solvent's useful life. A new solvent has also been formulated for use in the cyclonic unit. The solvent is less flammable (flash point of 150 degrees F.), has less odor, and has lower air emissions than previously used solvents. The new solvent is non-chlorinated and does not contain any ozone depleting compounds.

**4.3 Scale of Operation:** Fully Operational

**4.4 State of Development:** Fully implemented

**4.5 Level of Commercialization:** This "Green Machine" is used by service stations, auto dealers, and a large variety of other industries. By 1994, approximately 40% of the company's parts washer units (over 100,000 units) will have switched to the new waste minimization machine. By the end of 1995, the Company forecasts that 90% of its parts washer units (over 230,000 units) will have been converted over to the "Green Machine".

**4.6 Balances & Substitutions:** In 1993, customers using the firm's parts cleaning machine generated approximately 25,000,000 gallons of waste solvent. For 1994, the firm estimates that these customers will generate approximately 18,600,000 gallons of waste solvent for a reduction of 6,900,000 gallons of waste due to the introduction of the "Green Machine". For 1995, it is estimated that the volume will be reduced to about 13,400,000 gallons, nearly 12,000,000 gallons less than 1993. It is important to note that over 90% of these reductions will be realized by small generators. The system and cleaning agents are being continuously improved as the company works with customers to further reduce environmental impacts of their operations.

**5.0 ECONOMICS:** Minimum cost savings to customers.

**6.0 DATE CASE STUDY WAS PERFORMED:** 1994

**7.0 CONTACTS & CITATION:**

Safety Kleen
1000 North Randall Road
Elgin, IL 60123-7857

Bill Constantelos - 708/468-2217, fax 708/468-8535

## Appendix C - Supplemental Actions EPA Is Investigating

This section describes several additional actions which EPA is exploring, and if appropriate, will make plans to implement. They are listed according to the objectives in the National Plan.

<u>Objective 2</u>

- **EPA will evaluate the cross-media impacts of source reduction and recycling activities for specific constituents.**

The Agency wants to encourage stakeholders (in particular, state technical assistance centers, academic institutions, and industrial facilities) to examine the potential "life cycle" impacts from adoption of source reduction and recycling alternatives, as their resources permit. EPA plans to support this effort by evaluating potential impacts of selected source reduction and recycling alternatives for constituents that are a high-priority from a national standpoint.

In the near term, EPA plans to examine the potential effects of source reduction and recycling alternatives for a couple of selected industrial sectors generating high-priority metal constituents, based on the results presented in the Addendum to the Plan. This examination would address potential cross-media transfers, as well as impacts on energy and water usage.

- **EPA will explore the relationship between the goals of reducing persistent, bioaccumulative, and toxic constituents identified in this Plan with the goals of each Common Sense Initiative Sector that the Agency is pursuing.**

The Common Sense Initiative has three goals: 1) to eliminate problems caused by focusing too narrowly on a single pollutant or environmental medium (thereby resulting in cross-media transfers); 2) to stop the practice of making policy in response to emergencies; and 3) to try to bridge the gap separating environmentalists and industry by holding regular meetings with EPA and interested parties to discuss differences and reach agreement on major issues. This Waste Minimization National Plan has been developed with very similar principles.

Although this Plan does focus on constituents, it attempts to understand which industrial sectors and processes result in the generation of these constituents in wastes, and then proceeds to focus on those processes for which source reduction and recycling opportunities may exist.

EPA will look at the relationship of the persistent, bioaccumulative, and toxic constituents in this Plan to the six industries that the Common Sense Initiative is focusing on (i.e., iron and steel, electronics and computers, metal plating and finishing, automobiles, printing, and oil refining). In particular, EPA will share information on processes within these sectors that generate wastestreams containing these persistent, bioaccumulative, and toxic constituents, and any information on source reduction and recycling opportunities that may exist, or that should be developed that would result in a reduction of these constituents.

Although there has been little formal discussion in this context, the Common Sense Initiatives could serve as a vehicle to pilot many of the concepts that are presented in this National Plan, such as the use of a screening tool to identify source reduction and recycling priorities; the use of a combination of voluntary, regulatory, and organization mechanisms to achieve reductions; optimization of flexibility to both States and industry to get real reductions; and effective partnerships that lead to efficient, effective, and innovative implementation of actions to achieve waste minimization goals stated here today.

Objective 3

♦ **EPA will investigate whether activities already underway can aid in accomplishing the goals stated in this Plan. Possible opportunities to investigate include:**

  o **Potential expansion of the 33/50 Program and other EPA initiated voluntary programs to incorporate priority constituents identified through the screening tool described under Objective #1.**

  o **Developing or expanding an already existing Leadership/Recognition Program to support both State and industry source reduction efforts aimed at priority constituents.**

EPA will be investigating the value of using existing vehicles, such as the Environmental Leadership Program, to get further movement in reductions of constituents of concern. Many generators have been proactive and responsible in their efforts to reduce the use of toxic substances through source reduction, reduce releases of toxics to the environment, and increase their use of environmentally sound recycling. EPA wants to see an increase in the trend toward industry's commitment to preventing pollution.

Objective 4

♦ **EPA will investigate measurement techniques for evaluating progress toward the national goal.**

After identifying the necessary data and defining the level of detail needed to assess national progress toward the goal, EPA will investigate measurement techniques (including defining appropriate data collection approaches and mechanisms) to evaluate the progress. The recommendations from the four state pilot projects described in the National Plan will be one starting point for developing these measurement techniques. EPA anticipates reviewing the usefulness of measurement methods that have already been developed by States and industry to measure progress.

- **EPA will explore establishing a process by which Regions, States, and industry are accountable to the public in continually improving their reductions in hazardous constituents.**

Regardless of the mechanisms that are used to achieve the stated goals, there is a need for industry, States, and EPA to document progress towards these goals, and to be accountable to the public on their intentions in setting their own priorities and meeting their own stated goals, and how these do or do not complement the national priorities and goals. EPA expects that a process will be needed to communicate the Regions', States', and industry's progress to the general public.

EPA will investigate the use of the Biennial Report, the Capacity Assurance Plan process, the Waste Minimization Program in Place Certification, and the Toxics Release Inventory, as viable and defensible mechanisms for demonstrating progress and being accountable to the public.

ADDENDUM

APPLICATION OF WASTE MINIMIZATION NATIONAL PLAN

TO THE

COMBUSTION UNIVERSE

## ADDENDUM: APPLICATION OF WASTE MINIMIZATION NATIONAL PLAN APPROACH TO THE COMBUSTION UNIVERSE

### Background

In this addendum to the Waste Minimization National Plan, EPA applies a screening tool and sets initial national priorities for metals contained in hazardous wastes treated by combustion facilities and metals in releases from combustion facilities. This approach serves as a point of departure for EPA Regions, States, and industry in establishing their own priorities.

In applying the screening tool, the Agency has chosen to focus on metals at combustion facilities because they are not destroyed by combustion and are therefore potentially available to the environment following management. The Agency believes that promotion of source reduction and environmentally-sound recycling for these metals will contribute in important ways to managing risks from combustion, consistent with the goals of the Waste Minimization and Combustion Strategy.

EPA is not currently applying this approach to halogenated organic compounds in wastes treated by combustion facilities or halogenated organics in releases from these facilities, as was proposed in the Draft Waste Minimization National Plan. EPA plans to address halogens in a broader array of wastes and releases using a broader screening tool, as discussed below and in the Waste Minimization National Plan. EPA plans to address dioxins from hazardous waste combustion facilities specifically as part of the Agency's on-going Dioxin Reassessment.

The screening tool described in this addendum is a prototype for a broader screening tool, to be developed, that will focus primarily on an "as-generated" approach to prioritizing constituents in wastes and in TRI transfers to off-site management. The broader screening tool will also be supplemented by an "as-managed" approach for TRI releases to address those situations where certain industrial sources and waste management practices may pose significant hazards. The core of the broader screening tool will be the assessment of hazard based on the persistence, bioaccumulation, and toxicity of constituents, weighted by constituent mass.

It will take additional time to develop the broader screening tool, based on the many comments already received on EPA's draft methodology. EPA expects to make the screening tool available (at least in draft) in 1995.

In the near term, EPA will begin to implement its Plan by applying its prototype screening methodology to metals in combustion facility wastes and releases. EPA plans to use these results to set initial national priorities for source reduction and environmentally-sound recycling in the context of the Waste Minimization and Combustion Strategy.

For this application of the prototype methodology, EPA is using elements of the draft methodology outlined in the document "Setting Priorities for Hazardous Waste Minimization," July 1994 (draft report). This methodology set priorities for combusted hazardous wastes "as generated," based on the persistence, bioaccumulation, toxicity, and mass of constituents in the wastes. Two primary modifications were made to the draft methodology for this application: (1) EPA is using the draft methodology to assess the hazard of metals only (rather than both metals and halogens) in wastes, and (2) EPA is also applying the draft methodology to TRI releases reported by combustion facilities.[1]

It should be noted that this application is based on national-level data on wastestreams and TRI releases. Application of this type of tool to the wastes and releases at a state or facility level could result in a different ordering of priorities (e.g., a different relative ranking of metals), since the metal content of wastes and releases is likely to vary significantly from state to state and facility to facility.

## Methodology

### Revisions to Draft Methodology for Prioritizing Hazardous Wastes

EPA prioritized metals in combusted hazardous wastes using the same data sources and applying the same general methodology described in "Setting Priorities for Hazardous Waste Minimization," July 1994 (draft report). As discussed in Chapter 2 of this report, Biennial Reporting System data reported in 1991 were used to characterize waste generation and management. Data from a variety of sources were used to develop estimates of constituent content and concentrations in about 150 large-quantity "wastestream combinations"[2] representing approximately 50 percent of routinely-generated hazardous wastes going to combustion.

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[1] This type of methodology could also potentially be applied to transfers reported in the TRI (e.g., off-site transfers to publicly-owned treatment works, treatment facilities, and recycling facilities), using the same basic approach as for wastes "as generated." Due to time constraints, EPA has not applied the methodology to TRI transfers in this addendum.

[2] EPA created "wastestream combinations" by combining combusted wastestreams that were identical in terms of the RCRA hazardous waste codes; the generator's Standard Industrial Classification and source (or process); and waste form.

As discussed in Chapter 3 of this report, the draft methodology uses a waste characteristics scoring component from Superfund's Hazard Ranking System (HRS), with some modification. The methodology determines hazard as generated based on persistence, bioaccumulation, toxicity, and/or mobility for four primary pathways (air, surface water, ground water, and soil) and weights the result by constituent mass.[3] The highest pathway score for a given constituent is used to represent the constituent's hazard, and the highest constituent score for a given wastestream is used to represent the wastestream's hazard.

One of the key differences of the application in this addendum from the draft methodology is the focus here on prioritizing metals only. The waste characterization work described in Chapter 2 and in Appendix 6 of the report was modified for this application by removing halogens and other non-metal constituents from the top 150 wastestream combinations. This was done to avoid the "masking" of metals by non-metals.[4] This left 80 wastestream combinations containing metals. Once non-metals had been removed, hazard scores were added across wastestreams by metal to determine "high-hazard metals."

**Application of Draft Methodology to TRI Releases from Combustion Facilities**

One of the other key differences of the application in this addendum from the work presented in the draft report is the use of the methodology to assess the relative hazard of TRI releases. The Agency recognizes that there are a variety of TRI-based screening approaches (as well as other non-TRI-based approaches) already in use or under development that could be used as alternatives to the approach employed here. As discussed in the Waste Minimization National Plan, the Agency plans to examine these alternative approaches in developing the broader screening tool for setting priorities for source reduction and environmentally-sound recycling. However, to demonstrate how TRI data might be used along with waste data in setting priorities, the Agency has started with the HRS-based approach, which could be readily employed and is internally consistent with the current

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[3] All of the constituent mass in the wastestream is assumed to be available to any of the pathways.

[4] Only the score for the "hazard-driving constituent" in each wastestream (see Exhibit 3-4 in "Setting Priorities") was used in the draft methodology to tally the total hazard score by constituent and determine which were the most hazardous constituents across all wastestreams. If a halogen in a particular wastestream had a higher hazard score than a metal in that wastestream, the metal score was not tallied (i.e., was masked).

approach for ranking constituents in wastes.

In assessing the hazard of TRI metal releases from hazardous waste incinerators and from boilers and industrial furnaces (BIFs), the Agency started with a recent estimate of the universe of these combustion facilities. Based on May 1994 data, there were 265 facilities that were incinerators and/or BIFs, including 55 commercial facilities and 210 non-commercial facilities. The Agency used the EPA ID numbers of these facilities to identify the 35 facilities with thermal treatment processes[5] reporting releases of metals in the 1992 TRI. Only a small subset of combustion facilities currently report metals releases under TRI because they do not manage metal-bearing wastestreams in combustion units, they do not meet reporting thresholds, or they do not fall within the industrial sectors required to report under the TRI.[6]

In the TRI, facilities separately report their releases to air, land, underground injection, and water. For each metal, EPA added release quantities across the 35 facilities to obtain estimates of total national releases by release type (e.g., EPA estimated the total releases of cadmium to air from point and non-point sources at the 35 facilities).

Once national estimates had been derived of the mass of each metal by release type, EPA applied one or more of the pathway algorithms from the HRS-based draft methodology to each release type, as shown in Exhibit 1.[7] For example, for releases to air, all four HRS-based pathways (air, surface water, ground water, and soil) were applied, since releases to air could potentially result in exposures via any of these pathways. The highest scoring pathway was then used to obtain the hazard score for a given metal and release type. For each metal, EPA then added hazard scores across release types to obtain an aggregate hazard

[5] This includes facilities reporting incineration/thermal treatment (F) codes or energy recovery (U) codes in the TRI.

[6] Facilities falling in Standard Industrial Classification codes 20-39 are required to report under TRI.

[7] The air pathway algorithm from the HRS-based draft methodology was modified slightly in applying it to TRI air releases, by assuming that the "mobility" factor for air equals 1 (i.e., the pathway score for air is based on toxicity alone). This was done since the mobility factor for air, based on vapor pressure, is more an expression of the potential for constituent release to air than of constituent movement once in air. TRI releases reflect constituents already present in air; therefore the mobility factor was not needed.

score (e.g., EPA added the hazard score for cadmium released to air to the hazard score for cadmium released to water, etc. to obtain the total hazard score for cadmium).[8]

Results

**Revisions to Draft Screening Results for Hazardous Wastes**

Focusing just on metal constituents present in combusted hazardous wastes, hazard ranking results parallel the results presented originally in Exhibit 3-5 of "Setting Priorities for Hazardous Waste Minimization." As shown below in Exhibit 2, the top-ranking constituents are cadmium, lead, mercury, selenium, and copper. Cadmium is responsible for approximately three quarters of the overall hazard score, followed by lead with 12 percent, and mercury with 8 percent.

Although EPA intends to focus primarily on constituents, rather than wastes, in setting priorities for source reduction and environmentally-sound recycling, it is useful to understand which wastestreams the priority constituents are present in and which industrial sectors and sources generate the wastes, in order to identify source reduction and recycling opportunities. Exhibit 3, below, is a revised version of Exhibit 3-4 from "Setting Priorities," which shows the large-quantity wastestream combinations that EPA characterized and the metal that was the highest-hazard constituent for each wastestream combination. Exhibit 4, a revised version of Exhibit 3-7 from the draft report, shows the ranking of industrial sectors and sources based on the hazard of the wastestreams they generate. Exhibit 5, a revised version of Appendix 9 from the draft report, shows which Regions and States the wastestream combinations were generated in. (Please note that the hazard scores shown in Exhibits 3, 4, and 5 do not represent any absolute measure of the magnitude of hazard or risk; only the relative difference between scores is significant.)

**Results of Application of Draft Methodology to TRI Releases**

Based on the application of the HRS-based ranking methodology to the TRI metal releases reported by the 35 hazardous waste combustion facilities, the highest-hazard metals are lead, copper, mercury, and silver. The hazard rankings for

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[8] The hazard score for each metal was obtained by adding hazard scores across pathways (rather than selecting the highest-scoring pathway) to account for the total mass of the constituent released to the environment. This parallels the approach used for estimating the hazard of wastes, where all the mass of a constituent was assumed to be available when estimating each of the pathway scores.

these and other metals in TRI releases are shown in Exhibit 6. As shown, lead accounts for about three quarters of the total hazard score for metals, and copper accounts for 20 percent.

**Overlap Between Waste and Release Results**

The top-scoring metals present in TRI releases (shown in Exhibit 6) overlap to a limited extent, on a national basis, with the top-scoring metals present in hazardous wastestreams (shown in Exhibit 2). One constituent that appears prominently on both lists is lead; mercury also appears near the top of both lists.

The limited overlap in high-ranking metals is not surprising, for at least two reasons:

- The constituent content of wastes may or may not be related to the constituents present in TRI releases, depending on the industrial processes and waste management practices employed at facilities and on the physical and chemical properties of the constituents.

- The TRI metals releases at the 35 combustion facilities reporting releases may not be representative of the releases at the overall universe of 265 facilities receiving hazardous wastes.

At a facility level, where this type of screening tool would most often be applied in practice, the overlap between metals in releases and wastes may be somewhat stronger (for facilities both generating waste and reporting releases).

<u>Conclusions and Recommendations for Implementation</u>

EPA applied the prototype screening methodology to national-level data on metals contained in combustion wastes and in releases from combustion facilities in order to set initial national priorities and begin to implement the Waste Minimization National Plan. This application is also meant to illustrate how a broader screening tool could potentially be applied to other constituents in wastes and releases and how it could be applied to State or facility-level data.

Consistent with EPA's emphasis on the hazard of wastes as generated as the primary basis for setting priorities, the results for ranking of metals in hazardous wastes as generated should serve as the starting point for setting Regional, State, and industry priorities. Results for ranking of TRI releases of metals should be used to reinforce waste-based priorities (where there are common high-priority constituents between wastes and releases) and to identify releases of other metals that may also be of potential concern and good candidates for source reduction or recycling activities.

The screening results provided here for the top-ranking metals, the wastestreams containing the metals, and the industrial sources generating the wastestreams (augmented by results for top-ranking metals in TRI releases) serve as a starting point for setting national source reduction and recycling priorities. These initial results will be incorporated in RCRA program activities for 1995-6. However, these results should not preclude Regions, States, and industry from: conducting more detailed characterization of these and other wastestreams (or releases) containing metals; applying alternative prioritization approaches, when appropriate, to the metals; and modifying these initial national-level priorities accordingly.

Limitations of Screening Approach

In interpreting the results presented above, it is important to consider the following points.

- Results for hazardous wastes reflect 1991 Biennial Reporting System data, current as of March 1994 (the most data at the time the analysis for "Setting Priorities" was conducted). These data do not reflect more recent State updates of the BRS data (as part of the Capacity Assurance Planning process). However, these updates did not significantly change overall waste quantities and should therefore not alter the basic national-level results reported here.

- Results for hazardous wastes are based on best estimates of average waste characteristics for the top-volume wastestream combinations representing approximately 50 percent of the routinely-generated combusted waste universe. More detailed characterization of these wastestreams and/or characterization of the other 50 percent of the universe could alter the draft national results reported above.

- Results for TRI releases assume that the entire mass of the releases is potentially available to the environment. The approach does not consider reductions in availability of mass due to controls or treatment (e.g., liners in landfills or stabilization of metals).

- TRI data indicate which facilities conduct thermal treatment processes but do not indicate which specific releases result from these processes (i.e, releases are not unit-specific). The metal release numbers could reflect releases from other sources or processes in addition to releases from combustion units. The estimates of constituent mass released therefore serve as upper bound estimates of releases from thermal treatment units.

- In the TRI, metals can be reported as elemental metals or as "metal compounds." EPA assumed that the entire mass reported of a metal compound was present in the form of the elemental metal. This assumption could result in either an understatement or overstatement of toxicity and hazard.

- As discussed in the Waste Minimization National Plan, EPA is developing a broader screening tool. With application of the broader tool, these initial results for metals in wastes and releases could change.

Exhibit 1. HRS-Based Pathways Applied to TRI Release Types

| Type of TRI Release | Highest Scoring Among Following HRS-Based Pathways Was Used to Estimate Hazard of Release | Rationale |
|---|---|---|
| Air (point and non-point) | Air, surface water, ground water, and soil pathways | Air releases could result in direct exposures via air; could be deposited to surface water, and, once in surface water, could contaminate ground water; could be deposited onto land |
| Land (landfill, surface impoundment, land application, other) | Air, surface water, ground water, and soil pathways | Releases to land could be transported to air, surface water, ground water, or soil |
| Underground injection | Ground water and surface water (ground water to surface water) pathways | Releases to underground injection could be transported to ground water, and, once in ground water, could enter surface water; however releases could not directly enter surface water |
| Water | Air, surface water, ground water, and soil pathways | Releases to surface water could be transported to air, ground water, or soil |

Exhibit 2. Hazard Ranking of Metals in Large-Quantity Combusted Hazardous Wastestreams

| Metal | Percent of Overall Metal Hazard Score |
|---|---|
| Cadmium | 77 |
| Lead | 12 |
| Mercury | 8 |
| Selenium | 1 |
| Copper | 1 |
| Beryllium | <1 |
| Silver | <1 |
| Chromium | <1 |
| Nickel | <1 |

## EXHIBIT 3

## TOP 80 METAL-CONTAINING WASTESTREAM COMBINATIONS, RANKED BY HAZARD SCORES

| Rank | Wastestream Combination | SIC Code | Source Code | Form Code | Volume (Tons) | Hazard-Driving Constituent | Wastestream Combination Score | Cum. Percent | Volume Rank |
|---|---|---|---|---|---|---|---|---|---|
| 1 | D002 D006 | 2833 | A32 | B207 | 3724 | Cadmium | 3.72E+13 | 73.2 | 125 |
| 2 | F003 F005 | | | B219 | 17218 | Mercury | 2.58E+12 | 78.3 | 34 |
| 3 | D001 D008 F003 F005 | 4953 | A73 | B203 | 4880 | Lead | 2.43E+12 | 83.1 | 98 |
| 4 | K002 | 2865 | A33 | B203 | 6554 | Lead | 6.54E+11 | 84.4 | 79 |
| 5 | D001 D005 D006 D007 D008 D018 D026 D035 F001 F002 | | | B219 | 31348 | Cadmium | 6.26E+11 | 85.6 | 17 |
| 6 | D001 D002 | 2869 | A31 | B207 | 3873 | Copper | 5.80E+11 | 86.8 | 121 |
| 7 | D001 F001 F002 F003 | | | B204 | 10782 | Selenium | 5.38E+11 | 87.8 | 55 |
| 8 | D001 D008 | 2821 | A33 | B602 | 13395 | Lead | 5.35E+11 | 88.9 | 44 |
| 9 | K048 K049 K051 | | | | 3393 | Mercury | 5.08E+11 | 89.9 | 134 |
| 10 | F003 F005 | 2819 | A | B | 6101 | Lead | 4.57E+11 | 90.8 | 84 |
| 11 | D001 F003 F005 | | | B203 | 5692 | Lead | 4.54E+11 | 91.7 | 90 |
| 12 | D001 D004 D005 D006 D007 | | | B204 | 22251 | Cadmium | 4.44E+11 | 92.5 | 25 |
| 13 | K051 | 2911 | A89 | B603 | 6217 | Lead | 2.92E+11 | 93.1 | 83 |
| 14 | D001 D004 D005 D006 D007 D008 D009 D010 D011 D016 | | | B202 | 6591 | Mercury | 2.63E+11 | 93.6 | 78 |
| 15 | D001 F003 F005 | | | B204 | 8747 | Lead | 2.62E+11 | 94.2 | 60 |
| 16 | D001 D004 D005 D006 D007 D008 D009 D010 D011 D018 | | | B202 | 5565 | Mercury | 2.22E+11 | 94.6 | 92 |
| 17 | D001 D005 D006 D007 D008 | 7389 | A89 | B204 | 10883 | Cadmium | 2.17E+11 | 95.0 | 53 |
| 18 | D001 D004 D005 D006 D007 D008 D009 D010 D016 F001 | 7389 | A71 | B219 | 4743 | Mercury | 1.89E+11 | 95.4 | 103 |
| 19 | D001 D002 D003 D008 D018 D023 D024 D025 D026 | 2869 | A33 | B219 | 18825 | Lead | 1.88E+11 | 95.8 | 27 |
| 20 | D001 D002 D003 D004 D005 D006 D007 D008 D009 D010 | 4953 | A99 | B114 | 4564 | Mercury | 1.82E+11 | 96.1 | 106 |
| 21 | D001 D004 D005 D006 D007 D008 D010 D011 D018 D035 | 2899 | A89 | B204 | 4531 | Mercury | 1.81E+11 | 96.5 | 107 |
| 22 | D001 D005 D006 D007 D008 | | | B407 | 7826 | Cadmium | 1.56E+11 | 96.8 | 68 |
| 23 | D001 D005 D006 D007 D008 D009 D019 F001 F002 F003 | | | B407 | 2999 | Mercury | 1.20E+11 | 97.0 | 144 |
| 24 | | 3221 | A54 | B206 | 7914 | Lead | 1.18E+11 | 97.3 | 67 |
| 25 | D018 F037 F038 K048 K049 K050 K051 | 2911 | A75 | B603 | 10580 | Lead | 1.06E+11 | 97.5 | 57 |
| 26 | D001 D004 D005 D006 D007 | | | B407 | 4509 | Cadmium | 9.00E+10 | 97.6 | 108 |
| 27 | D005 D006 D008 F001 | 4953 | | B204 | 4348 | Cadmium | 8.68E+10 | 97.8 | 111 |
| 28 | D001 D007 D008 D018 | 2911 | A89 | B204 | 8564 | Lead | 8.54E+10 | 98.0 | 61 |
| 29 | | | | B206 | 84191 | Lead | 7.56E+10 | 98.1 | 5 |
| 30 | D001 D005 D006 D007 | | | B204 | 3775 | Cadmium | 7.53E+10 | 98.3 | 124 |
| 31 | D001 F001 F003 F005 | | | B204 | 5956 | Selenium | 7.43E+10 | 98.4 | 86 |
| 32 | D001 D007 D008 D018 D022 D026 D027 D028 D033 D036 | 9999 | A99 | B219 | 7001 | Lead | 6.98E+10 | 98.6 | 71 |
| 33 | D001 D005 D006 D007 D008 F003 F005 | 2821 | A73 | B602 | 3410 | Cadmium | 6.80E+10 | 98.7 | 133 |
| 34 | D001 D002 D005 D006 | 4953 | | B204 | 3295 | Cadmium | 6.57E+10 | 98.8 | 136 |
| 35 | D001 D006 D008 F002 | | | B403 | 3168 | Cadmium | 6.32E+10 | 98.9 | 138 |
| 36 | F001 F002 F003 F005 | | | B204 | 6975 | Selenium | 6.26E+10 | 99.1 | 73 |
| 37 | D001 D005 D006 D007 D008 D011 D022 D035 D039 F001 | | | | 3124 | Cadmium | 6.23E+10 | 99.2 | 140 |
| 38 | D001 D028 F037 F038 | 2911 | A89 | B205 | 6785 | Lead | 5.75E+10 | 99.3 | 75 |
| 39 | D001 D002 D007 D008 D018 D035 F001 F003 F005 U009 | 2869 | A37 | B219 | 5679 | Lead | 5.67E+10 | 99.4 | 91 |
| 40 | D008 | | | | 5357 | Lead | 5.34E+10 | 99.5 | 95 |
| 41 | D001 D007 D008 F001 F002 F003 F005 | 9999 | | B202 | 4866 | Lead | 4.85E+10 | 99.6 | 99 |
| 42 | D001 D018 K048 K049 | 2911 | | B204 | 3669 | Lead | 3.66E+10 | 99.7 | 126 |
| 43 | D001 F004 | 2821 | A33 | B602 | 3990 | Beryllium | 3.18E+10 | 99.8 | 119 |

EXHIBIT 3

## TOP 80 METAL-CONTAINING WASTESTREAM COMBINATIONS, RANKED BY HAZARD SCORES

| Rank | Wastestream Combination | SIC Code | Source Code | Form Code | Volume (Tons) | Hazard-Driving Constituent | Wastestream Combination Score | Cum. Percent | Volume Rank |
|---|---|---|---|---|---|---|---|---|---|
| 44 | D001 F001 F002 F003 | 2899 | A89 | B204 | 5825 | Selenium | 2.91E+10 | 99.8 | 88 |
| 45 | D001 | 2512 | A92 | B403 | 4322 | Lead | 2.59E+10 | 99.9 | 112 |
| 46 | F001 F002 F003 | | | | 4822 | Selenium | 2.41E+10 | 99.9 | 101 |
| 47 | D001 D011 D018 D021 D022 | 3861 | A49 | B204 | 9390 | Silver | 9.37E+09 | 99.9 | 59 |
| 48 | D001 D002 D003 D004 D005 D006 D007 D008 D009 D010 | 2869 | A33 | B105 | 13182 | Cadmium | 6.58E+09 | 99.9 | 45 |
| 49 | K048 | 2911 | A75 | B503 | 19996 | Lead | 5.99E+09 | 100.0 | 26 |
| 50 | D001 F003 F005 | 3053 | A56 | B403 | 3465 | Lead | 4.32E+09 | 100.0 | 131 |
| 51 | D001 D002 D007 | 2869 | A33 | B602 | 36709 | Chromium | 3.66E+09 | 100.0 | 14 |
| 52 | K049 | 2911 | A75 | B202 | 3316 | Mercury | 3.31E+09 | 100.0 | 135 |
| 53 | D001 D005 D006 D007 D008 F001 F002 F003 F004 F005 | 7389 | A71 | B206 | 3518 | Lead | 3.16E+09 | 100.0 | 129 |
| 54 | D001 D002 | 2869 | A35 | B219 | 95042 | Copper | 1.90E+09 | 100.0 | 4 |
| 55 | D001 D002 D007 | 2869 | A33 | B219 | 16099 | Chromium | 1.61E+09 | 100.0 | 36 |
| 56 | D001 D002 D003 | 2879 | A37 | B102 | 27247 | Selenium | 8.16E+08 | 100.0 | 19 |
| 57 | D002 | 2869 | A09 | B207 | 8001 | Copper | 7.98E+08 | 100.0 | 65 |
| 58 | D001 | 2869 | A35 | B219 | 12842 | Mercury | 6.41E+08 | 100.0 | 47 |
| 59 | D001 | 2822 | | | 3068 | Mercury | 6.12E+08 | 100.0 | 142 |
| 60 | D001 | 2869 | A35 | B207 | 10732 | Lead | 5.35E+08 | 100.0 | 56 |
| 61 | D001 D002 D007 D018 D021 F002 F003 F005 | 2865 | A31 | B204 | 4781 | Chromium | 4.77E+08 | 100.0 | 102 |
| 62 | K022 | 2865 | A33 | B602 | 9432 | Cadmium | 4.71E+08 | 100.0 | 58 |
| 63 | D001 D002 D007 D018 D021 F002 F003 F005 | 2865 | A34 | B204 | 4316 | Chromium | 4.31E+08 | 100.0 | 113 |
| 64 | D001 D002 | 2819 | A37 | B219 | 15997 | Copper | 3.19E+08 | 100.0 | 37 |
| 65 | D001 D002 D003 D007 D018 D019 D021 D022 D028 | 2869 | A33 | B212 | 2900 | Chromium | 2.89E+08 | 100.0 | 148 |
| 66 | K022 | 2869 | A33 | B606 | 23281 | Mercury | 2.32E+08 | 100.0 | 24 |
| 67 | K022 | 2865 | A35 | B602 | 4609 | Cadmium | 2.30E+08 | 100.0 | 105 |
| 68 | D001 D002 D019 D032 D033 D034 D039 F002 | 2869 | A33 | B219 | 3866 | Lead | 1.93E+08 | 100.0 | 122 |
| 69 | D001 D002 | | | | 3477 | Lead | 1.73E+08 | 100.0 | 130 |
| 70 | D001 D022 | 2869 | A37 | B202 | 3414 | Lead | 1.70E+08 | 100.0 | 132 |
| 71 | D001 D002 | 9999 | A | B | 2969 | Lead | 1.48E+08 | 100.0 | 146 |
| 72 | D001 D002 | 2869 | A33 | B219 | 7412 | Copper | 1.48E+08 | 100.0 | 70 |
| 73 | D001 D002 | 2821 | A49 | B102 | 2868 | Lead | 1.43E+08 | 100.0 | 149 |
| 74 | K022 | 2869 | A33 | B219 | 10846 | Cadmium | 1.08E+08 | 100.0 | 54 |
| 75 | D001 D002 F003 | 2819 | A | B | 5323 | Mercury | 1.06E+08 | 100.0 | 96 |
| 76 | D001 D002 U008 U113 | 2869 | A33 | B101 | 189524 | Chromium | 1.89E+07 | 100.0 | 1 |
| 77 | K027 | 2865 | A33 | B409 | 11123 | Nickel | 4.44E+05 | 100.0 | 49 |
| 78 | K027 | 2865 | A33 | B403 | 4457 | Nickel | 1.78E+05 | 100.0 | 110 |
| 79 | D001 K013 U003 | 2869 | A33 | B219 | 5554 | Lead | 1.66E+05 | 100.0 | 93 |
| 80 | D018 D038 K022 K083 | 2865 | A | B | 17303 | Nickel | 3.45E+04 | 100.0 | 33 |
| | Total | | | | | | 5.08E+13 | | |

## EXHIBIT 4

## SIC/SOURCE CODE COMBINATIONS, RANKED BY HAZARD SCORES

| Rank | SIC Code Description | SIC Code | Source Code Description | Source Code | Hazard Score | % Hazard Score | Cum. %. Of Haz. Score |
|---|---|---|---|---|---|---|---|
| 1 | Medicinal Chemicals and Botanical Products | 2833 | Product filtering | A32 | 3.72E+13 | 73.2 | 73.2 |
| 2 | | Unk. | | Unk | 6.75E+12 | 13.3 | 86.5 |
| 3 | Refuse Systems | 4953 | Solvents recovery | A73 | 2.43E+12 | 4.8 | 91.3 |
| 4 | Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments | 2865 | Product distillation | A33 | 6.54E+11 | 1.3 | 92.6 |
| 5 | Industrial Organic Chemicals, N.E.C. | 2869 | Product rinsing | A31 | 5.80E+11 | 1.1 | 93.7 |
| 6 | Plastics Materials, Synthetic Resins, and Nonvulcanizable Elastomers | 2821 | Product distillation | A33 | 5.66E+11 | 1.1 | 94.9 |
| 7 | Industrial Inorganic Chemicals, N.E.C. | 2819 | | Unk | 4.57E+11 | 0.9 | 95.8 |
| 8 | Petroleum Refining | 2911 | Other pollution control or waste treatment | A89 | 4.35E+11 | 0.9 | 96.6 |
| 9 | Business Services, N.E.C. | 7389 | Other pollution control or waste treatment | A89 | 2.17E+11 | 0.4 | 97.0 |
| 10 | Chemicals and Chemical Preparations, N.E.C. | 2899 | Other pollution control or waste treatment | A89 | 2.10E+11 | 0.4 | 97.5 |
| 11 | Industrial Organic Chemicals, N.E.C. | 2869 | Product distillation | A33 | 2.01E+11 | 0.4 | 97.9 |
| 12 | Business Services, N.E.C. | 7389 | Filtering/screening | A71 | 1.92E+11 | 0.4 | 98.2 |
| 13 | Refuse Systems | 4953 | Other | A99 | 1.82E+11 | 0.4 | 98.6 |
| 14 | Refuse Systems | 4953 | | Unk | 1.53E+11 | 0.3 | 98.9 |
| 15 | Glass Containers | 3221 | Oil changes | A54 | 1.18E+11 | 0.2 | 99.1 |
| 16 | Petroleum Refining | 2911 | Wastewater treatment | A75 | 1.15E+11 | 0.2 | 99.4 |
| 17 | Nonclassifiable Establishments | 9999 | Other | A99 | 6.98E+10 | 0.1 | 99.5 |
| 18 | Plastics Materials, Synthetic Resins, and Nonvulcanizable Elastomers | 2821 | Solvents recovery | A73 | 6.80E+10 | 0.1 | 99.6 |
| 19 | Industrial Organic Chemicals, N.E.C. | 2869 | Spent process liquids removal | A37 | 5.68E+10 | 0.1 | 99.7 |
| 20 | Nonclassifiable Establishments | 9999 | | Unk | 4.87E+10 | 0.1 | 99.8 |
| 21 | Petroleum Refining | 2911 | | Unk | 3.66E+10 | 0.1 | 99.9 |
| 22 | Wood Household Furniture, Upholstered | 2512 | Routine cleanup wastes | A92 | 2.59E+10 | 0.1 | 100.0 |
| 23 | Photographic Equipment and Supplies | 3861 | Other non–surface preparation processes | A49 | 9.37E+09 | 0.0 | 100.0 |
| 24 | Gaskets, Packing, and Sealing Devices | 3053 | Discontinue use of process equipment | A56 | 4.32E+09 | 0.0 | 100.0 |
| 25 | Industrial Organic Chemicals, N.E.C. | 2869 | By–product processing | A35 | 3.07E+09 | 0.0 | 100.0 |
| 26 | Pesticides and Agricultural Chemicals, N.E.C. | 2879 | Spent process liquids removal | A37 | 8.16E+08 | 0.0 | 100.0 |
| 27 | Industrial Organic Chemicals, N.E.C. | 2869 | Clean out process equipment | A09 | 7.98E+08 | 0.0 | 100.0 |
| 28 | Synthetic Rubber (Vulcanizable Elastomers) | 2822 | | Unk | 6.12E+08 | 0.0 | 100.0 |
| 29 | Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments | 2865 | Product rinsing | A31 | 4.77E+08 | 0.0 | 100.0 |
| 30 | Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments | 2865 | Product solvent extraction | A34 | 4.31E+08 | 0.0 | 100.0 |
| 31 | Industrial Inorganic Chemicals, N.E.C. | 2819 | Spent process liquids removal | A37 | 3.19E+08 | 0.0 | 100.0 |
| 32 | Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments | 2865 | By–product processing | A35 | 2.30E+08 | 0.0 | 100.0 |
| 33 | Plastics Materials, Synthetic Resins, and Nonvulcanizable Elastomers | 2821 | Other non–surface preparation processes | A49 | 1.43E+08 | 0.0 | 100.0 |
| 34 | Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments | 2865 | | Unk | 3.45E+04 | 0.0 | 100.0 |
| | Total | | | | 5.07E+13 | | |

# EXHIBIT 5

## TOP 80 RANKED WASTESTREAM COMBINATIONS WITH GENERATING STATES AND REGIONS

| Rank | RCRA Code | SIC Code | Source Code | Form Code | Hazard Score | Volume (Tons) | State | EPA Region |
|---|---|---|---|---|---|---|---|---|
| 1 | D002 D006 | 2833 | A32 | B207 | 3.7E+13 | 3724.88 | CT | 1 |
| 2 | F003 F005 | Unk. | Unk | B219 | 2.6E+12 | 20.25 | CT | 1 |
| | F003 F005 | Unk. | Unk | B219 | 2.6E+12 | 1325.1 | MA | 1 |
| | F003 F005 | Unk. | Unk | B219 | 2.6E+12 | 613.95 | NJ | 2 |
| | F003 F005 | Unk. | Unk | B219 | 2.6E+12 | 248.59 | NY | 2 |
| | F003 F005 | Unk. | Unk | B219 | 2.6E+12 | 45.05 | PA | 3 |
| | F003 F005 | Unk. | Unk | B219 | 2.6E+12 | 14.67 | VA | 3 |
| | F003 F005 | Unk. | Unk | B219 | 2.6E+12 | 17.81 | WV | 3 |
| 3 | D001 D008 F003 F005 | 4953 | A73 | B203 | 2.4E+12 | 4880.02 | KY | 4 |
| 4 | K002 | 2865 | A33 | B203 | 6.5E+11 | 6554.5 | LA | 6 |
| 5 | D001 D005 D006 D007 D008 D018 D026 D035 F001 F002 | Unk. | Unk | B219 | 6.3E+11 | 31348.19 | MI | 5 |
| 6 | D001 D002 | 2869 | A31 | B207 | 5.8E+11 | 3873 | VA | 3 |
| 7 | D001 F001 F002 F003 | Unk. | Unk | B204 | 5.4E+11 | 1.88 | FL | 4 |
| | D001 F001 F002 F003 | Unk. | Unk | B204 | 5.4E+11 | 745.82 | KY | 4 |
| | D001 F001 F002 F003 | Unk. | Unk | B204 | 5.4E+11 | 0.92 | IN | 5 |
| | D001 F001 F002 F003 | Unk. | Unk | B204 | 5.4E+11 | 1553.42 | OH | 5 |
| | D001 F001 F002 F003 | Unk. | Unk | B204 | 5.4E+11 | 1482.27 | WI | 5 |
| | D001 F001 F002 F003 | Unk. | Unk | B204 | 5.4E+11 | 6.61 | IA | 7 |
| 8 | D001 D008 | 2821 | A33 | B602 | 5.3E+11 | 13395.7 | KY | 4 |
| 9 | K048 K049 K051 | Unk. | Unk | Unk. | 5.1E+11 | 1612.8 | OH | 5 |
| | K048 K049 K051 | Unk. | Unk | Unk. | 5.1E+11 | 1626.38 | LA | 6 |
| 10 | F003 F005 | 2819 | Unk | Unk. | 4.6E+11 | 320.42 | TN | 4 |
| 11 | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 5.91 | CT | 1 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 5.62 | MA | 1 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 101.51 | ME | 1 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 70.48 | NJ | 2 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 55.59 | NY | 2 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 34.49 | MD | 3 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 6.08 | PA | 3 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 3.68 | VA | 3 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 704.15 | AL | 4 |

# EXHIBIT 5

## TOP 80 RANKED WASTESTREAM COMBINATIONS WITH GENERATING STATES AND REGIONS

| Rank | RCRA Code | SIC Code | Source Code | Form Code | Hazard Score | Volume (Tons) | State | EPA Region |
|---|---|---|---|---|---|---|---|---|
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 10.49 | FL | 4 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 151.51 | MS | 4 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 2.2 | NC | 4 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 52.93 | SC | 4 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 11.87 | TN | 4 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 13.01 | IN | 5 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 66.24 | MI | 5 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 9.66 | MN | 5 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 1.04 | OH | 5 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 5.23 | LA | 6 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 1.71 | KS | 7 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 1.4 | MO | 7 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 9.4 | CO | 8 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 1.29 | ND | 8 |
| | D001 F003 F005 | Unk. | Unk | B203 | 4.5E+11 | 9.51 | CA | 9 |
| 12 | D001 D004 D005 D006 D007 | Unk. | Unk | B204 | 4.4E+11 | 503.37 | TN | 4 |
| | D001 D004 D005 D006 D007 | Unk. | Unk | B204 | 4.4E+11 | 662.11 | IN | 5 |
| | D001 D004 D005 D006 D007 | Unk. | Unk | B204 | 4.4E+11 | 21086.04 | MI | 5 |
| 13 | K051 | 2911 | A89 | B603 | 2.9E+11 | 2530.88 | TX | 6 |
| 14 | D001 D004 D005 D006 D007 D008 D009 D010 D011 D016 | Unk. | Unk | B202 | 2.6E+11 | 6591 | MO | 7 |
| 15 | D001 F003 F005 | Unk. | Unk | B204 | 2.6E+11 | 72.04 | NJ | 2 |
| | D001 F003 F005 | Unk. | Unk | B204 | 2.6E+11 | 33.08 | VA | 3 |
| | D001 F003 F005 | Unk. | Unk | B204 | 2.6E+11 | 7.82 | WV | 3 |
| | D001 F003 F005 | Unk. | Unk | B204 | 2.6E+11 | 10.96 | KY | 4 |
| | D001 F003 F005 | Unk. | Unk | B204 | 2.6E+11 | 5.14 | IL | 5 |
| | D001 F003 F005 | Unk. | Unk | B204 | 2.6E+11 | 65.49 | IN | 5 |
| | D001 F003 F005 | Unk. | Unk | B204 | 2.6E+11 | 1716.23 | MI | 5 |
| | D001 F003 F005 | Unk. | Unk | B204 | 2.6E+11 | 10.4 | OH | 5 |
| | D001 F003 F005 | Unk. | Unk | B204 | 2.6E+11 | 51.77 | MO | 7 |
| | D001 F003 F005 | Unk. | Unk | B204 | 2.6E+11 | 6.82 | NE | 7 |
| | D001 F003 F005 | Unk. | Unk | B204 | 2.6E+11 | 26.53 | CA | 9 |

# EXHIBIT 5

## TOP 80 RANKED WASTESTREAM COMBINATIONS WITH GENERATING STATES AND REGIONS

| Rank | RCRA Code | SIC Code | Source Code | Form Code | Hazard Score | Volume (Tons) | State | EPA Region |
|---|---|---|---|---|---|---|---|---|
| 16 | D001 D004 D005 D006 D007 D008 D009 D010 D011 D018 | Unk. | Unk | B202 | 2.2E+11 | 1524 | AL | 4 |
| | D001 D004 D005 D006 D007 D008 D009 D010 D011 D018 | Unk. | Unk | B202 | 2.2E+11 | 1507 | TN | 4 |
| | D001 D004 D005 D006 D007 D008 D009 D010 D011 D018 | Unk. | Unk | B202 | 2.2E+11 | 938 | CA | 9 |
| 17 | D001 D005 D006 D007 D008 | 7389 | A89 | B204 | 2.2E+11 | 10883.06 | TX | 6 |
| 18 | D001 D004 D005 D006 D007 D008 D009 D010 D016 F001 | 7389 | A71 | B219 | 1.9E+11 | 4743.09 | TX | 6 |
| 19 | D001 D002 D003 D008 D018 D023 D024 D025 D026 | 2869 | A33 | B219 | 1.9E+11 | 9581.65 | TX | 6 |
| 20 | D001 D002 D003 D004 D005 D006 D007 D008 D009 D010 | 4953 | A99 | B114 | 1.8E+11 | 4564.7 | TX | 6 |
| 21 | D001 D004 D005 D006 D007 D008 D010 D011 D018 D035 | 2899 | A89 | B204 | 1.8E+11 | 4531.4 | AL | 4 |
| 22 | D001 D005 D006 D007 D008 | Unk. | Unk | B407 | 1.6E+11 | 502.89 | MI | 5 |
| | D001 D005 D006 D007 D008 | Unk. | Unk | B407 | 1.6E+11 | 7323.96 | AR | 6 |
| 23 | D001 D005 D006 D007 D008 D009 D019 F001 F002 F003 | Unk. | Unk | B407 | 1.2E+11 | 2999.42 | AR | 6 |
| 24 | | 3221 | A54 | B206 | 1.2E+11 | 6220.58 | NJ | 2 |
| 25 | D018 F037 F038 K048 K049 K050 K051 | 2911 | A75 | B603 | 1.1E+11 | 10580 | LA | 6 |
| 26 | D001 D004 D005 D006 D007 | Unk. | Unk | B407 | 9.0E+10 | 2504.52 | GA | 4 |
| | D001 D004 D005 D006 D007 | Unk. | Unk | B407 | 9.0E+10 | 257.48 | TX | 6 |
| 27 | D005 D006 D008 F001 | 4953 | Unk | B204 | 8.7E+10 | 4348.14 | OH | 5 |
| 28 | D001 D007 D008 D018 | 2911 | A89 | B204 | 8.5E+10 | 8564.82 | OH | 5 |
| 29 | | Unk. | Unk | B206 | 7.6E+10 | 1.51 | CT | 1 |
| | | Unk. | Unk | B206 | 7.6E+10 | 898.69 | RI | 1 |
| | | Unk. | Unk | B206 | 7.6E+10 | 10.06 | NJ | 2 |
| | | Unk. | Unk | B206 | 7.6E+10 | 6.11 | DE | 3 |
| | | Unk. | Unk | B206 | 7.6E+10 | 166.51 | MD | 3 |
| | | Unk. | Unk | B206 | 7.6E+10 | 38.7 | PA | 3 |
| | | Unk. | Unk | B206 | 7.6E+10 | 370.38 | VA | 3 |
| | | Unk. | Unk | B206 | 7.6E+10 | 95.55 | IL | 5 |
| | | Unk. | Unk | B206 | 7.6E+10 | 129.65 | TX | 6 |
| | | Unk. | Unk | B206 | 7.6E+10 | 12.95 | IA | 7 |
| | | Unk. | Unk | B206 | 7.6E+10 | 1.33 | KS | 7 |
| | | Unk. | Unk | B206 | 7.6E+10 | 2.96 | MO | 7 |
| | | Unk. | Unk | B206 | 7.6E+10 | 1777.03 | CA | 9 |
| 30 | D001 D005 D006 D007 | Unk. | Unk | B204 | 7.5E+10 | 3775.38 | OH | 5 |

# EXHIBIT 5

## TOP 80 RANKED WASTESTREAM COMBINATIONS WITH GENERATING STATES AND REGIONS

| Rank | RCRA Code | SIC Code | Source Code | Form Code | Hazard Score | Volume (Tons) | State | EPA Region |
|---|---|---|---|---|---|---|---|---|
| 31 | D001 F001 F003 F005 | Unk. | Unk | B204 | 7.4E+10 | 36.07 | RI | 1 |
| | D001 F001 F003 F005 | Unk. | Unk | B204 | 7.4E+10 | 94.32 | NY | 2 |
| | D001 F001 F003 F005 | Unk. | Unk | B204 | 7.4E+10 | 1.2 | IL | 5 |
| | D001 F001 F003 F005 | Unk. | Unk | B204 | 7.4E+10 | 1905.18 | MI | 5 |
| | D001 F001 F003 F005 | Unk. | Unk | B204 | 7.4E+10 | 130.74 | OH | 5 |
| | D001 F001 F003 F005 | Unk. | Unk | B204 | 7.4E+10 | 0.98 | NM | 6 |
| 32 | D001 D007 D008 D018 D022 D026 D027 D028 D033 D036 | 9999 | A99 | B219 | 7.0E+10 | 7001.93 | IN | 5 |
| 33 | D001 D005 D006 D007 D008 F003 F005 | 2821 | A73 | B602 | 6.8E+10 | 3410.43 | WI | 5 |
| 34 | D001 D002 D005 D006 | 4953 | Unk | B204 | 6.6E+10 | 3295.85 | OH | 5 |
| 35 | D001 D006 D008 F002 | Unk. | Unk | B403 | 6.3E+10 | 2300 | OH | 5 |
| | D001 D006 D008 F002 | Unk. | Unk | B403 | 6.3E+10 | 868 | TX | 6 |
| 36 | F001 F002 F003 F005 | Unk. | Unk | B204 | 6.3E+10 | 6952.6 | PR | 2 |
| | F001 F002 F003 F005 | Unk. | Unk | B204 | 6.3E+10 | 2.86 | FL | 4 |
| | F001 F002 F003 F005 | Unk. | Unk | B204 | 6.3E+10 | 17.41 | IN | 5 |
| | F001 F002 F003 F005 | Unk. | Unk | B204 | 6.3E+10 | 2.67 | TX | 6 |
| 37 | D001 D005 D006 D007 D008 D011 D022 D035 D039 F001 | Unk. | Unk | Unk. | 6.2E+10 | 3124 | OH | 5 |
| 38 | D001 D028 F037 F038 | 2911 | A89 | B205 | 5.8E+10 | 6785.02 | TX | 6 |
| 39 | D001 D002 D007 D008 D018 D035 F001 F003 F005 U009 | 2869 | A37 | B219 | 5.7E+10 | 5679 | TX | 6 |
| 40 | D008 | Unk. | Unk | Unk. | 5.3E+10 | 5.2 | MA | 1 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 4.8 | VT | 1 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 3.5 | NY | 2 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 34.98 | FL | 4 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 1.6 | KY | 4 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 16.8 | NC | 4 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 33.6 | SC | 4 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 7.3 | TN | 4 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 7.23 | IL | 5 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 8.92 | IN | 5 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 0.69 | MI | 5 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 1.2 | MN | 5 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 0.86 | OH | 5 |

# EXHIBIT 5

## TOP 80 RANKED WASTESTREAM COMBINATIONS WITH GENERATING STATES AND REGIONS

| Rank | RCRA Code | SIC Code | Source Code | Form Code | Hazard Score | Volume (Tons) | State | EPA Region |
|---|---|---|---|---|---|---|---|---|
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 2.75 | LA | 6 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | .2.92 | OK | 6 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 0.7 | TX | 6 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 256.39 | KS | 7 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 2 | MO | 7 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 4.82 | NE | 7 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 3.7 | AZ | 9 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 0.7 | CA | 9 |
| | D008 | Unk. | Unk | Unk. | 5.3E+10 | 3.4 | Q | 11 |
| 41 | D001 D007 D008 F001 F002 F003 F005 | 9999 | Unk | B202 | 4.9E+10 | 4866 | TN | 4 |
| 42 | D001 D018 K048 K049 | 2911 | Unk | B204 | 3.7E+10 | 3669.25 | OH | 5 |
| 43 | D001 F004 | 2821 | A33 | B602 | 3.2E+10 | 3990.1 | NY | 2 |
| 44 | D001 F001 F002 F003 | 2899 | A89 | B204 | 2.9E+10 | 5279.02 | AL | 4 |
| 45 | D001 | 2512 | A92 | B403 | 2.6E+10 | 4322.9 | NC | 4 |
| 46 | F001 F002 F003 | Unk. | Unk | Unk. | 2.4E+10 | 103.96 | NJ | 2 |
| | F001 F002 F003 | Unk. | Unk | Unk. | 2.4E+10 | 72.5 | GA | 4 |
| | F001 F002 F003 | Unk. | Unk | Unk. | 2.4E+10 | 2822.32 | TN | 4 |
| | F001 F002 F003 | Unk. | Unk | Unk. | 2.4E+10 | 44.68 | IN | 5 |
| | F001 F002 F003 | Unk. | Unk | Unk. | 2.4E+10 | 1647.09 | OH | 5 |
| | F001 F002 F003 | Unk. | Unk | Unk. | 2.4E+10 | 107.08 | TX | 6 |
| | F001 F002 F003 | Unk. | Unk | Unk. | 2.4E+10 | 22.93 | CO | 8 |
| 47 | D001 D011 D018 D021 D022 | 3861 | A49 | B204 | 9.4E+09 | 9376.37 | NY | 2 |
| 48 | D001 D002 D003 D004 D005 D006 D007 D008 D009 D010 | 2869 | A33 | B105 | 6.6E+09 | 13182.63 | TX | 6 |
| 49 | K048 | 2911 | A75 | B503 | 6.0E+09 | 19996 | TX | 6 |
| 50 | D001 F003 F005 | 3053 | A56 | B403 | 4.3E+09 | 3465 | VA | 3 |
| 51 | D001 D002 D007 | 2869 | A33 | B602 | 3.7E+09 | 36709 | TX | 6 |
| 52 | K049 | 2911 | A75 | B202 | 3.3E+09 | 3316 | IL | 5 |
| 53 | D001 D005 D006 D007 D008 F001 F002 F003 F004 F005 | 7389 | A71 | B206 | 3.2E+09 | 3518.1 | TX | 6 |
| 54 | D001 D002 | 2869 | A35 | B219 | 1.9E+09 | 92363 | TX | 6 |
| 55 | D001 D002 D007 | 2869 | A33 | B219 | 1.6E+09 | 4266.5 | TX | 6 |
| 56 | D001 D002 D003 | 2879 | A37 | B102 | 8.2E+08 | 27247.45 | TX | 6 |

## EXHIBIT 5

## TOP 80 RANKED WASTESTREAM COMBINATIONS WITH GENERATING STATES AND REGIONS

| Rank | RCRA Code | SIC Code | Source Code | Form Code | Hazard Score | Volume (Tons) | State | EPA Region |
|---|---|---|---|---|---|---|---|---|
| 57 | D002 | 2869 | A09 | B207 | 8.0E+08 | 8001.82 | TX | 6 |
| 58 | D001 | 2869 | A35 | B219 | 6.4E+08 | 27 | WV | 3 |
| | D001 | 2869 | A35 | B219 | 6.4E+08 | 290.3 | AL | 4 |
| | D001 | 2869 | A35 | B219 | 6.4E+08 | 50.3 | LA | 6 |
| | D001 | 2869 | A35 | B219 | 6.4E+08 | 11387 | TX | 6 |
| 59 | D001 | 2822 | Unk | Unk. | 6.1E+08 | 3068 | TX | 5 |
| 60 | D001 | 2869 | A35 | B207 | 5.4E+08 | 10250.52 | AR | 6 |
| 61 | D001 D002 D007 D018 D021 F002 F003 F005 | 2865 | A31 | B204 | 4.8E+08 | 2348.7 | TX | 6 |
| 62 | K022 | 2865 | A33 | B602 | 4.7E+08 | 9432 | AR | 6 |
| 63 | D001 D002 D007 D018 D021 F002 F003 F005 | 2865 | A34 | B204 | 4.3E+08 | 4316.71 | TX | 6 |
| 64 | D001 D002 | 2819 | A37 | B219 | 3.2E+08 | 15997 | IA | 6 |
| 65 | D001 D002 D003 D007 D018 D019 D021 D022 D028 | 2869 | A33 | B212 | 2.9E+08 | 2900 | PA | 7 |
| 66 | K022 | 2869 | A33 | B606 | 2.3E+08 | 23281.64 | TX | 3 |
| 67 | K022 | 2865 | A35 | B602 | 2.3E+08 | 4609.19 | TX | 6 |
| 68 | D001 D002 D019 D032 D033 D034 D039 F002 | 2869 | A33 | B219 | 1.9E+08 | 42.5 | MD | 6 |
| 69 | D001 D002 | Unk. | Unk | Unk. | 1.7E+08 | 56.42 | KY | 3 |
| | D001 D002 | Unk. | Unk | Unk. | 1.7E+08 | 136.64 | TN | 4 |
| | D001 D002 | Unk. | Unk | Unk. | 1.7E+08 | 2.29 | IL | 4 |
| | D001 D002 | Unk. | Unk | Unk. | 1.7E+08 | 1.06 | OH | 5 |
| | D001 D002 | Unk. | Unk | Unk. | 1.7E+08 | 167.6 | WI | 5 |
| | D001 D002 | Unk. | Unk | Unk. | 1.7E+08 | 6.35 | LA | 5 |
| | D001 D002 | Unk. | Unk | Unk. | 1.7E+08 | 7.19 | OK | 6 |
| | D001 D002 | Unk. | Unk | Unk. | 1.7E+08 | 14.98 | TX | 6 |
| | D001 D002 | Unk. | Unk | Unk. | 1.7E+08 | 3060.5 | CA | 6 |
| | D001 D002 | Unk. | Unk | Unk. | 1.7E+08 | 2.45 | LA | 9 |
| 70 | D001 D022 | 2869 | A37 | B202 | 1.7E+08 | 3414.5 | TN | 6 |
| 71 | D001 D002 | 9999 | Unk | Unk. | 1.5E+08 | 621.41 | VA | 4 |
| 72 | D001 D002 | 2869 | A33 | B219 | 1.5E+08 | 112.28 | TX | 3 |
| | D001 D002 | 2869 | A33 | B219 | 1.5E+08 | 7300.38 | CA | 6 |
| 73 | D001 D002 | 2821 | A49 | B102 | 1.4E+08 | 1828.55 | TX | 9 |
| 74 | K022 | 2869 | A33 | B219 | 1.1E+08 | 10846 | TN | 6 |

## EXHIBIT 5

## TOP 80 RANKED WASTESTREAM COMBINATIONS WITH GENERATING STATES AND REGIONS

| Rank | RCRA Code | SIC Code | Source Code | Form Code | Hazard Score | Volume (Tons) | State | EPA Region |
|---|---|---|---|---|---|---|---|---|
| 75 | D001 D002 F003 | 2819 | Unk | Unk. | 1.1E+08 | 596.35 | TX | 4 |
| 76 | D001 D002 U008 U113 | 2869 | A33 | B101 | 18908809 | 189524.4 | LA | 6 |
| 77 | K027 | 2865 | A33 | B409 | 443896.6 | 11123.19 | WV | 6 |
| 78 | K027 | 2865 | A33 | B403 | 177869.9 | 4457.09 | TX | 3 |
| 79 | D001 K013 U003 | 2869 | A33 | B219 | 166236.7 | 5554 | OH | 6 |
| 80 | D018 D038 K022 K083 | 2865 | Unk | Unk. | 34526.41 | 17303 | | 5 |

Exhibit 6. Hazard Ranking of Metals in Toxics Release Inventory Releases from Combustion Facilities

| Metal | Percent of Overall Metal Hazard Score |
|---|---|
| lead | 76 |
| copper | 20 |
| mercury | 3 |
| silver | <1 |
| cadmium | <1 |
| chromium | <1 |
| manganese | <1 |
| zinc | <1 |
| nickel | <1 |
| antimony | <1 |
| arsenic | <1 |
| barium | <1 |
| cobalt | <1 |